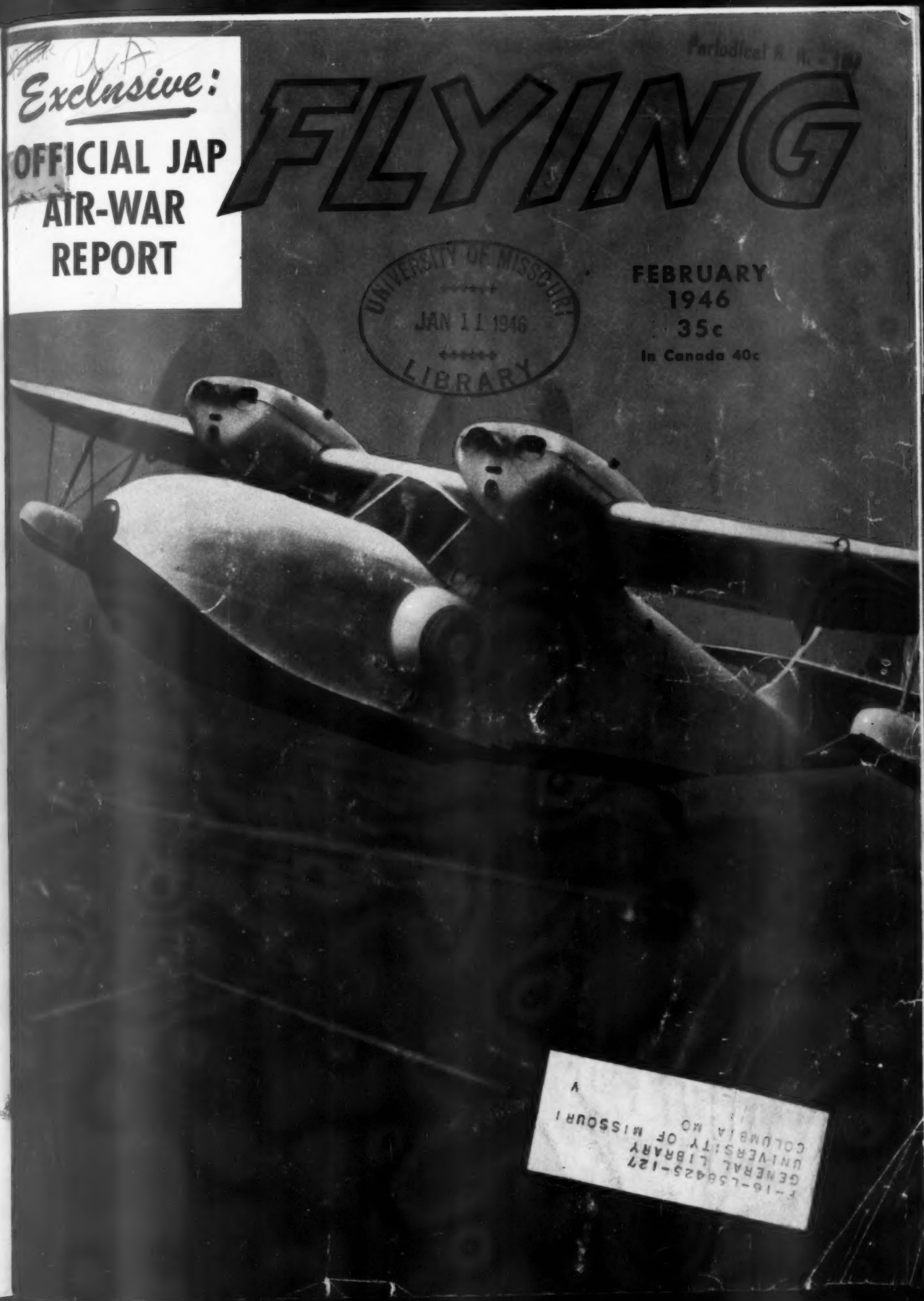

Exclusive:
OFFICIAL JAP AIR-WAR REPORT
FLYING
FEBRUARY
1946
35c
In Canada 40c
UNIVERSITY OF MISSOURI
JAN 11 1946
LIBRARY
GENERAL LIBRARY
UNIVERSITY OF MISSOURI
COLUMBIA MO

"Flight Test" Number One

You're looking at an Aeroprop ready for its final test before it goes into service. Those blades, shown in full-feathered position, are made of ribbed steel—tough yet light—highly resistant to erosion, corrosion, and damage.

The Aeroprop is unit-constructed. Within the compact hub is the complete pitch-changing mechanism, which requires no external source of energy. It is not dependent on the success or failure of other accessories. And unit-construction means simplified economical service, too.

Its "factory flight test" completed, this Aeroprop will go on one of the big ships now serving peacetime America. It will give the same efficient service that distinguished the thousands of Aeroprops used on every fighting front.

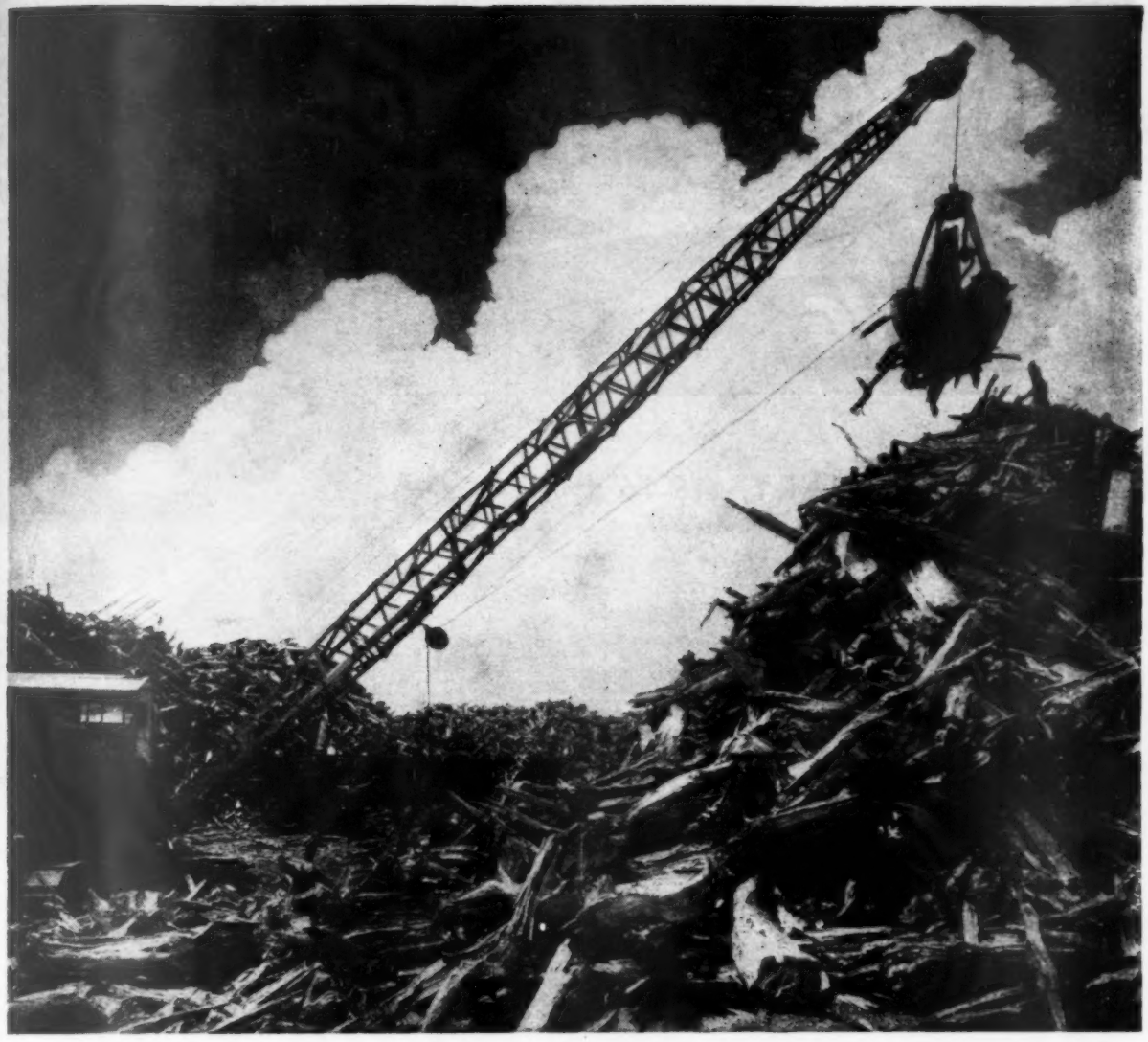
AEROPROP FACTS—The Aeroprop is a full-feathering propeller allowing an unlimited number of feathering cycles. It is also available with reversible pitch and all other features required for any installation. The regulator, hub, and blade assemblies are designed for unit installation or replacement. It is strong, light, simple—engineered for reliability and for continuous service with a minimum of maintenance costs.

Aeroprop

LIGHT • STRONG • RELIABLE

AEROPRODUCTS DIVISION • GENERAL MOTORS CORPORATION • DAYTON, OHIO

Keep America Strong—Buy Another Bond!



Found in a heap of pine stumps . . . a way to make tires better

SOME sort of soap is used in making all types of synthetic rubber for tires. At first, it was soap derived from animal fats. But out of pine stumps, like those in the picture, came the answer to making better tire synthetic rubber.

That answer is to use soap made from the *rosin* in pine stumps. B. F. Goodrich developed a new synthetic —GRS-10—with this important difference: Tires were made from the new rubber, and tests proved them so far superior that the development became an important military secret.

Tires made from the new rubber give more wear than tires made from ordinary synthetic. They run cooler. The rubber is more flexible, which is important in controlling cracking under heavy loads. Tires keep their strength. Tire life is increased.

Now all the synthetic rubber used in B. F. Goodrich airplane tires is the new GRS-10. That is typical of the B. F. Goodrich policy to make their Airplane Silvertowns always the finest, safest airplane tires on the market. That policy has caused B. F. Goodrich low-pressure Silvertowns to be the favorite of airline and private pilots for years. *The B. F. Goodrich Company, Aeronautical Division, Akron, Ohio.*

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER

FEBRUARY, 1946

VOLUME 38 • NUMBER 2

CIVIL AVIATION

'The Bite' ..... Fred Hamlin 21
Airway Inn 35
Fog 44
Maneuvering in Safety ..... H. R. Foottit 48
How to Fly in Winter ..... G. Sidney Stanton 83

MILITARY

Stop Blaming the Pilot! ..... Lieut. Wilfred Owen 24
Retraining the G. I. Mechanic ..... Phillips J. Peck 33
Push-Button Warfare ..... William Roger 38
Want to Buy a Carrier 46
Air Victory Over Japan 51

AIR COMMERCE

Super Airport ..... Fiorello H. LaGuardia 26
Local Airlines ..... Kurt Rand 30
Flying Huckster ..... Dick Washburne 40

NATIONAL POLICY

Aviation Reconverts to Peace ..... Richard O'Connor 28

DEPARTMENTS

Report from Washington ..... Franklin D. Walker 43
London Letter ..... Maj. Oliver Stewart 50
Have You Seen? 84
I Learned About Flying from That!—No. 75 ..... Robert Schwartz 87
The Library 88
Letters 90
AOPA News 92
Fifteen Years Ago 98
The Goldfish Club 104
Photo Credits 134

Cover Photo: Trimmer Amphibian by Commonwealth

WILLIAM B. ZIFF
Editor and Publisher

B. G. DAVIS
General Manager

MICHAEL H. FROELICH
Assistant to the Publisher

MAX KARANT
Managing Editor

CURTIS FULLER
Assistant Managing Editor

Associate Editors

CHICAGO
Paul Fountain, Lawrence Keil

WASHINGTON
Fred Hamlin, F. D. Walker

LOS ANGELES
Gaither Littrell

NEW YORK
William C. Hoff

Art Editor: Lew Merrell

Staff Photographer: Arthur Haug

HERMAN R. BOLLIN
Art Director

GEORGE BERNER
Advertising Director

H. G. STRONG
Circulation Director

H. J. MORGANROTH
Production Director

POPULAR PHOTOGRAPHY
RADIO NEWS
PLASTICS
INDUSTRIAL AVIATION

ZIFF-DAVIS PUBLISHING COMPANY

Copyright, 1945
ZIFF-DAVIS PUBLISHING COMPANY

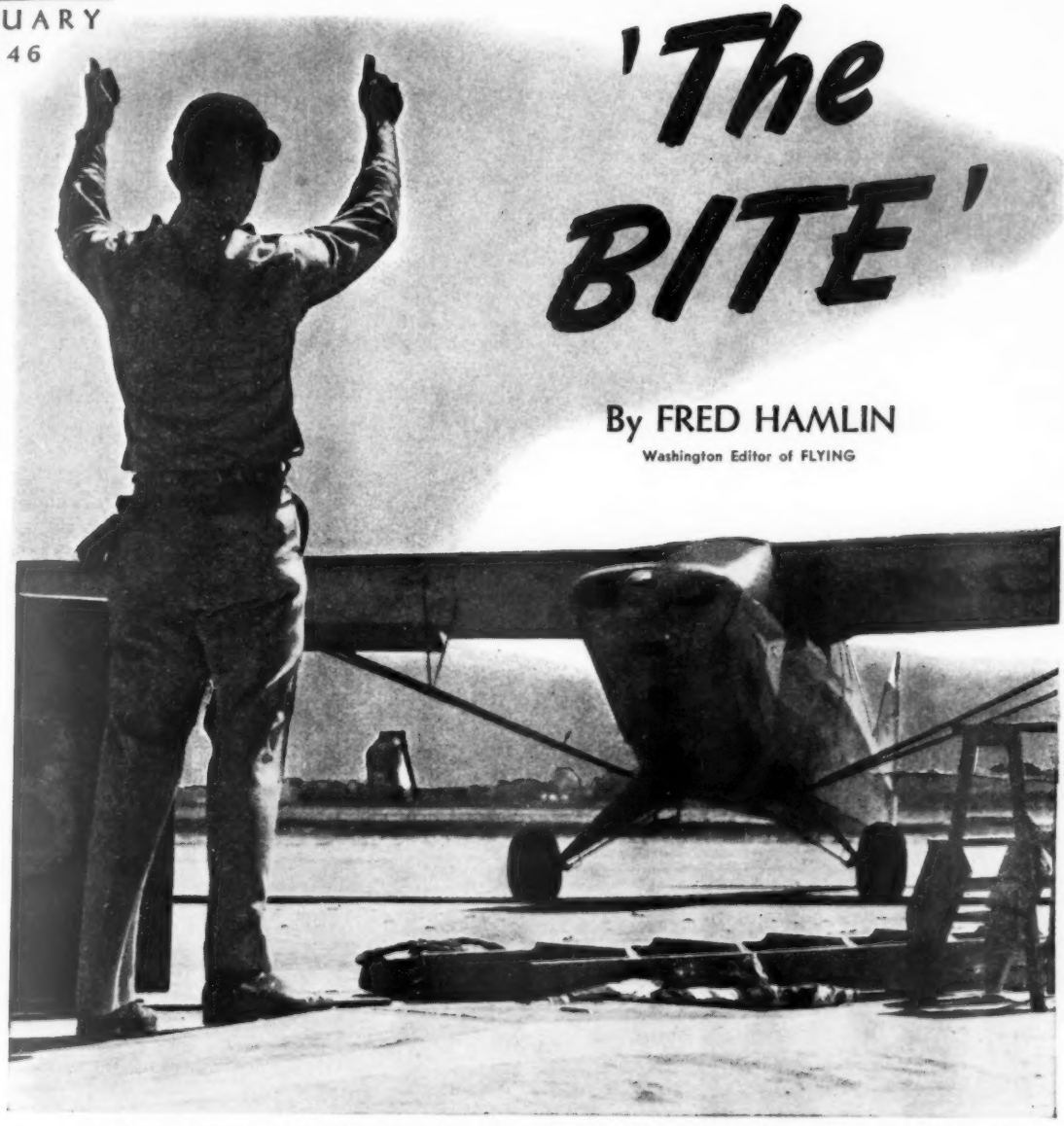
Editorial Offices, 185 N. Wabash Av., Chicago 1, Ill.
Member of the Audit Bureau of Circulations

FLYING is published monthly by Ziff-Davis Publishing Company at 185 N. Wabash Ave., Chicago 1, Ill. New York Office, Empire State Building, New York 1, N. Y., F. J. Crane, Eastern Advertising Manager. Los Angeles, Calif., William L. Pinney, Western Advertising Manager. William M. Springer, Midwestern Advertising Manager. Canadian Advertising Representative, G. J. McGeey, 21 King Street, East, Toronto. London Advertising Representative, J. Forecast, Newspaper Representations, Ltd., 231-232 Strand, London, W.C.2. Washington office, International Building, 1319 F Street N. W. SUBSCRIPTION RATES: In U. S., 12 issues, $4.00, single copies, 35 cents; in Mexico, South and Central America and U. S. Possessions, 12 issues, $4.00; in Canada, 12 issues $4.50, single copies 40 cents; in British Empire, 12 issues $5.00. All other foreign countries, 12 issues, $7.00. Subscribers should allow two weeks for change of address. Address all subscription letters to the Director of Circulation, FLYING, 185 N. Wabash Ave., Chicago 1. Entered as second class matter, September 8, 1942, at the Post Office, Chicago, Illinois, under the act of March 3, 1879. Entered as second class matter at the Post Office Department, Ottawa, Canada. Contributors should retain copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever adaptations and revisions are necessary to meet requirements. Payment covers all authors', contributors' and contestants' rights, title and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

'The BITE'

By FRED HAMLIN

Washington Editor of FLYING



Line boy directs transient plane in a well-run operation. High costs and lack of such services are private pilots' main gripes.

The shortsightedness of gouging operators impedes the expansion of personal flying.

IT WAS the high cost of flying, more than any other factor, that kept the private pilot grounded before the war. And this condition threatens to repeat itself in the much-heralded post-war era. Investigation discloses that the initial cost of almost anything in private flying is too high. Some of the more articulate members of the aviation industry blame the insurance companies, the engine manufacturers, the airlines, the Army, the Navy, and, above all others (including the law of gravity), the infamous CAA-CAB plotters.

But one of the worst culprits of all is the man who has habitually laid the blame on everyone but himself —the fixed-base operator.

While it is a matter of record that many fixed-base operators are doing their level best to cut down on the high cost of flying, it nevertheless is a fact that what appears to be a majority of such operators is gouging the private flyer, intentionally or otherwise. Such operators are directly responsible for fostering and continuing the practice that has come to be known among their victims as "The Bite."

Here's an example of The Bite from hundreds of cases on file in Washington:

A veteran purchased a damaged lightplane last spring from the Defense Plant Corporation and took it to a fixed-base operator for repairs, estimated to cost $250 and take 10 days. Two months and 10 days later, after many excuses from the operator he got his plane and

a bill for $572.42, including charges for a new rear seat—which wasn't installed—and for outdoor storage. According to the bill, a mechanic worked on the job an average of more than three hours a day, seven days a week, for as long as the plane was around the airport.

Our hero, being an honest guy, paid the bill. Then he did a double-take and read it more carefully. He came to a high boil and tried to organize a counter-attack.

He appealed to the operator and got a cold stare. He appealed to CAA and was told that it was powerless to control excessive charges. He appealed to the Aircraft Owners and Pilots Association and to his lawyer and was told that a suit would cost him more than it was worth. If he had refused to pay the bill he might have settled for less out of court, but to go to court was to risk further expenses and win only a feeling of satisfaction. He was, in sum, out of luck.

That case happened in the east, but The Bite is not limited by geography. A Wisconsin lightplane owner who was quoted a price of $300 for repairs got a bill for $975. He is suing, but The Bite will leave scars, regardless. Breaking down his bill, he discovered that he had been charged for 54 gallons of dope for the fuselage, as contrasted with an estimate from the plane's manufacturer that a dope job could be done on the entire plane with only 45 gallons. A set of impartial estimates on the amount of mechanic time needed to do the work outlined in the bill indicated that 175 hours would have been liberal. The bill itemized 421 hours of mechanic's labor, at $1.75 an hour.

From the west coast comes protest by another veteran. He and his wife were so enthusiastic about flying that they trimmed the family budget and bought a lightplane during the war, willing to foot the bill and the inconvenience of keeping the plane out of the coastal defense area, where they lived for the duration, in anticipation of peacetime pleasures to come. When the defense bans were lifted, a 100-hour check was needed before bringing the plane home. The bill: $300, some $20 of which was for parts, the rest for labor.

This is comparable to the experience of the California pilot who reports, "I thought I was paying a lot at $160 for an engine major, but I got off lucky compared with a friend of mine who paid $450 for exactly the same job. And it's about time I got off lucky. My Piper *Cub Coupe* was completely rebuilt when I got it. The bill for the job was $1,270!"

Two Virginia men report that labor charges not only are exorbitant at their base but that the operator violates the OPA ceilings. They are bringing suit. From Cleveland comes a report of an operator who upped his rates in the face of a long-standing price schedule of his own designing. A $15-a-month storage charge was raised overnight to $35, despite the fact that the old rate had prevailed even during the time when WTS programs were on and the problem of hangar space for private craft was acute.

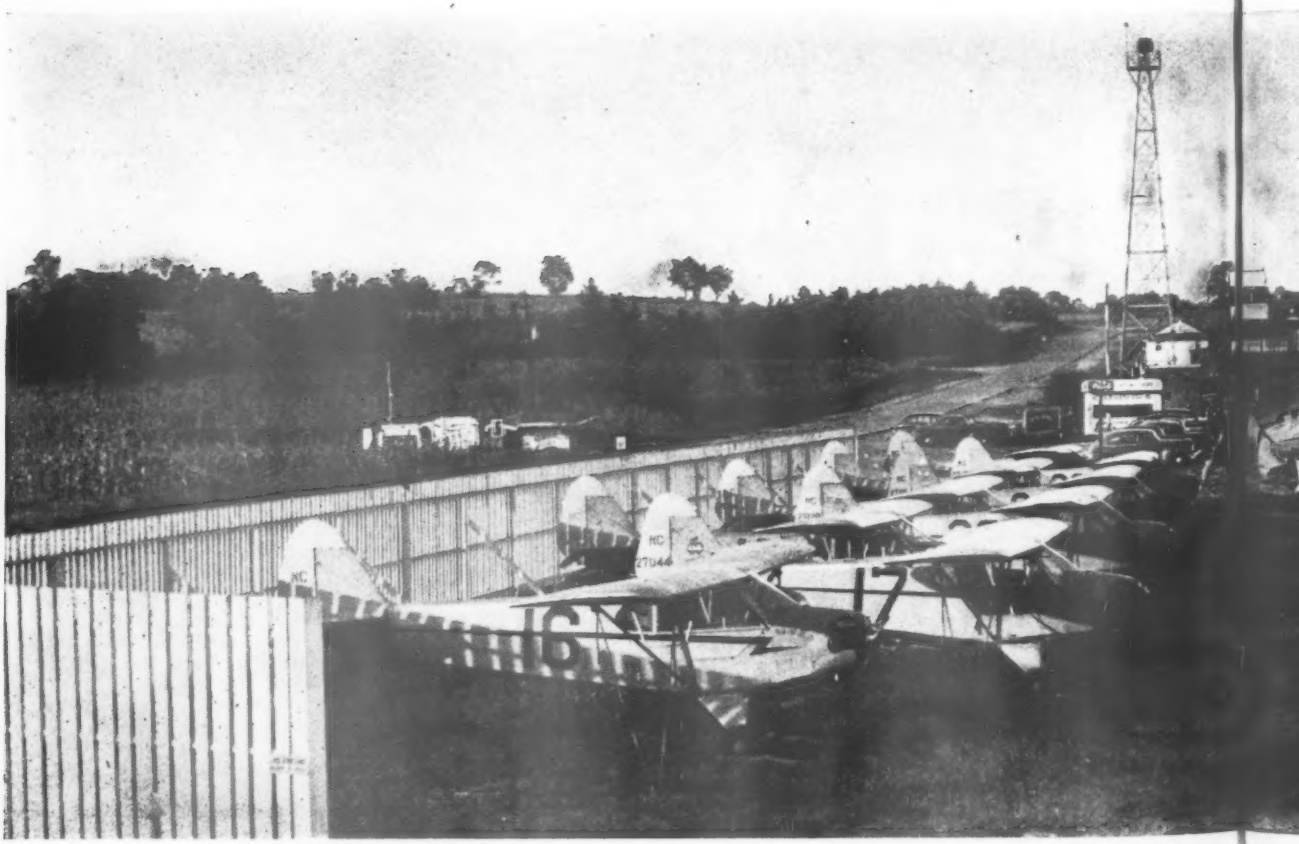
As with plane owners, so with plane renters. From another middlewestern field comes news that student pilots pay for the instructor's time even when on solo flights. The operator justifies this on the grounds that all student flights, even solo, are under instructor "supervision."

Charges for solo time in a coast-to-coast survey recently completed run as high as $12.50 an hour in lightplane, dual time as high as $15. Hangar rates at some fields are quoted at $3 per day, $30 per month. By contrast, lows for lightplane time solo run to $3.50 an hour, dual $6, hangar rentals as moderate as 50 cents a day, $5 a month.

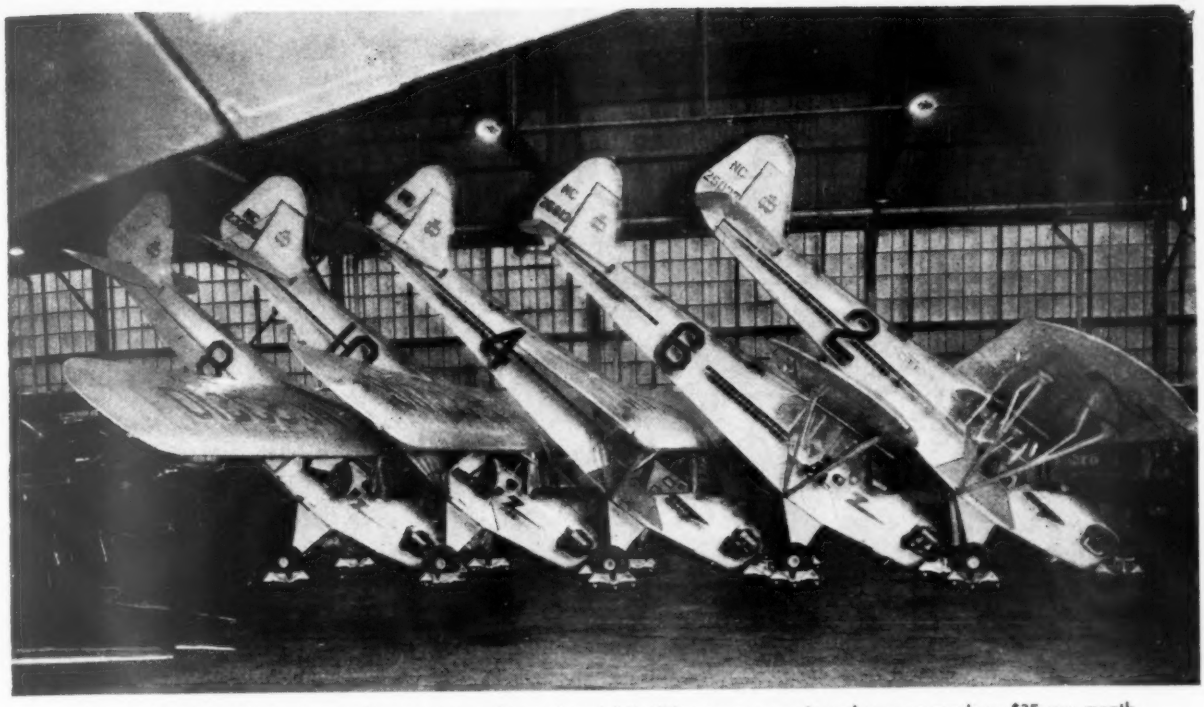
Both the highs and lows quoted here are, of course, exceptional. Statistics from 507 airports, coast-to-coast, show that the most prevalent lightplane solo rate is $7 at 146 airports, $8 at 132, $6 at 127. There also are 12 airports that charge $7.50.

For dual time the most prevalent

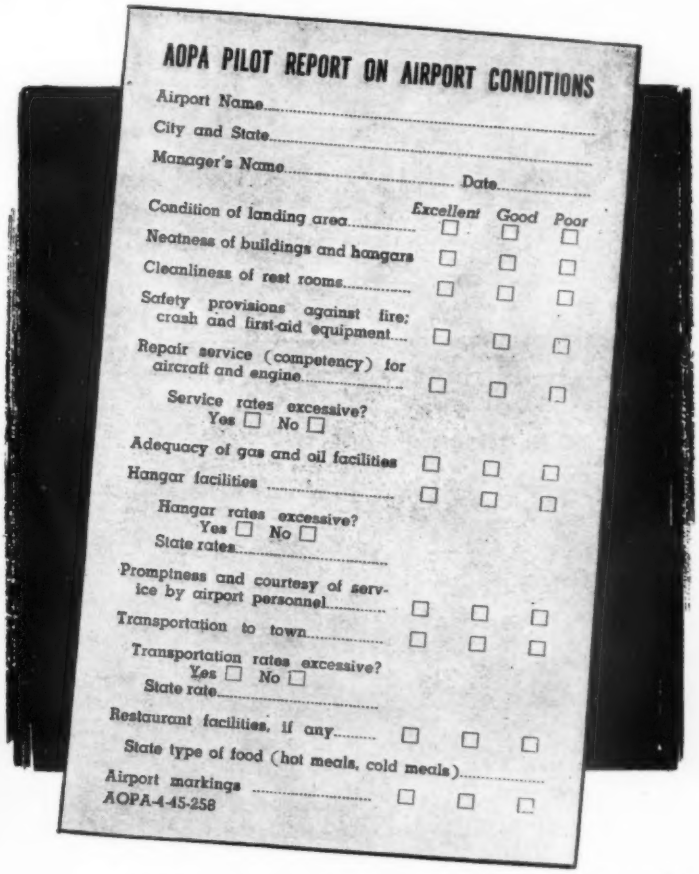
(*Continued on page* 118)



No tie-down charges at Owens Field, Columbia, S. C., though excellent service finds Cubs secured in level flight position. Lightplane hangar rentals are only $15 per month, transient charges $1 per night, compared with $30 and $3 at some other airports.



Cubs stacked with tails in air save hangar space. For such rental facilities, some operators charge as much as $35 per month, assume no responsibility for fabric tears or damage from careless handling. Poor service discourages plane ownership.



AOPA PILOT REPORT ON AIRPORT CONDITIONS

Airport Name.....

City and State.....

Manager's Name..... Date.....

	Excellent	Good	Poor
Condition of landing area	☐	☐	☐
Neatness of buildings and hangars	☐	☐	☐
Cleanliness of rest rooms	☐	☐	☐
Safety provisions against fire; crash and first-aid equipment	☐	☐	☐
Repair service (competency) for aircraft and engine	☐	☐	☐
Service rates excessive? Yes ☐ No ☐			
Adequacy of gas and oil facilities	☐	☐	☐
Hangar facilities	☐	☐	☐
Hangar rates excessive? Yes ☐ No ☐ State rates.....			
Promptness and courtesy of service by airport personnel	☐	☐	☐
Transportation to town	☐	☐	☐
Transportation rates excessive? Yes ☐ No ☐ State rate.....			
Restaurant facilities, if any	☐	☐	☐
State type of food (hot meals, cold meals).....			
Airport markings	☐	☐	☐

AOPA-4-45-258

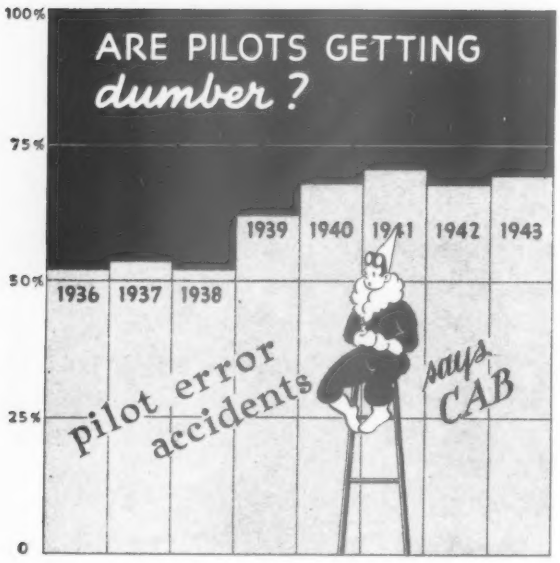
AOPA attacks problem of high costs through data sent in by members.

STOP BLAMING THE PILOT!

By LIEUT. WILFRED OWEN
Chief, Programs and Requirements, Office of Flying Safety

Is it always "pilot error?" AAF studies show plane design contributes to crashes.

Collision between Fleet (note broken propeller) and Luscombe probably resulted from poor visibility, not pilot error.



IT IS high time some one said a few kind words on behalf of the pilot. According to the official records, nearly 70 per cent of all private flying accidents are caused by pilot errors. Specific charges levied against the private flyer cannot be taken lightly. He is accused of being careless, negligent and, like a small boy, disobedient; with poor technique and bad judgment.

Those are the labels and they make you wonder what sort of a future there is for private aviation. Are the people who do the flying really hare-brained? Certainly if the pilot is most to blame for the safety record of personal aircraft, his case is none too good. In the past 15 years there have been more than 36,000 private airplane accidents in the United States and over 5,000 persons have been killed. And that was during a time when there were only 10,000 to 25,000 non-scheduled aircraft, all told.

With that kind of a record, what will happen a few years from now when the number of private planes multiplies to 300,000, or a million, or more? If estimates of 300,000 planes are realized in five years, even with continued improvement in the pre-war accident rate, there would still be a total of 48,000 serious accidents per year in the early 1950s, and nearly 5,000 persons killed each year.

It seems unlikely that the markets predicted for the private plane would be easy to realize or to maintain for long if private flying were to produce an accident total of this size. Of course, this is not a prediction of "things to come." It is merely a com-

putation, based on presently available information, of what will happen if steps are not taken to assure that they do not happen.

Already the upward surge in civil flying accidents is on. Up to the middle of August, when the war ended, civil aviation accidents for 1945 numbered only slightly more than for the same period of 1944—a 2.5 per cent increase to be exact.

But from the middle of August through the end of October, civil aviation accidents for 1945 were up 70 per cent over 1944. And during the first six months, there was a 52 per cent increase in fatal and serious injury accidents over the same period of 1944.

If it is true that seven out of every 10 aircraft accidents can be laid at the pilot's doorstep, then it is time we started to find out what ails him.

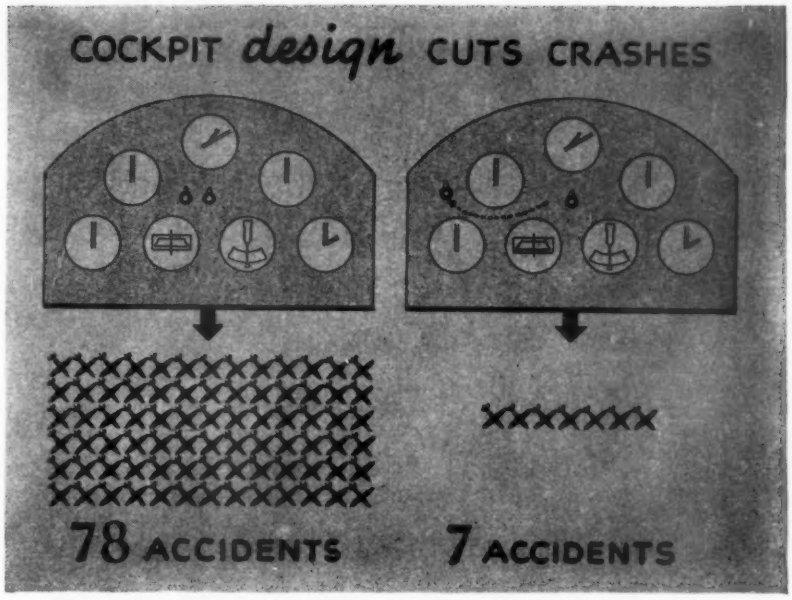
The Army has had a good opportunity to look at the pilot and his shortcomings. Army aircraft during the war flew very close to 100 million hours in this country alone, and if you can't decide what is wrong with the pilot in 11,415 years you never will. In the Army it was the same old story. Most of the accidents were said to be caused by pilot error, despite the fact that military pilots were quite carefully selected on the basis of brains as well as brawn.

As a matter of fact, during the entire war the Germans and Japs together didn't wreck as many AAF airplanes as accidents did. Altogether, during the war, over 22,000 Army aircraft were completely destroyed in non-combat accidents. There were, of course, thousands of major damage accidents not involving wrecks and tens of thousands of additional minor accidents.

According to the traditional analysis of accident causes, AAF pilots in 2½ years made exactly 41,036 rather disastrous errors. They would forget to lower the landing gear, or raise it when they didn't mean to. They would forget to switch fuel tanks or switch to any empty tank. They would read the instruments wrong and confuse every cockpit control that could be confused. If there was anything to bump into, they bumped into it. No amount of safety education seemed to educate.

There was something very familiar about all this loose talk about careless pilots. Industrial accidents, for example, were always blamed on careless workers. The machine operator would catch his hand in a moving part and the safety expert would say he was careless. But when machine guards were installed to prevent such a mistake there was no more such carelessness. Later on, the automobile driver earned a reputation for being reckless because he would run off the road at a curve or overturn on a soft shoulder. While neither the sharp curve nor the soft shoulder should have been there, blame for the accident was generally placed on poor driving rather than poor engineering.

It was the pilot's turn next. Blaming it on the pilot has become fashionable. But when you have a lot of accidents due to pilot error, a pattern begins to form which suggests that blaming pilots is no way to prevent accidents. The Army soon learned that what the pilot does wrong can very often be traced to what somebody else has failed to do right. The pilot is confused because aircraft design is confusing. He forgets because he has too much to remember. He is being asked to operate an airplane designed for the superman pilot, and there just aren't enough supermen to go around.



Redesigned cockpit reduced possibility of pilot's confusing gear and flap switches.

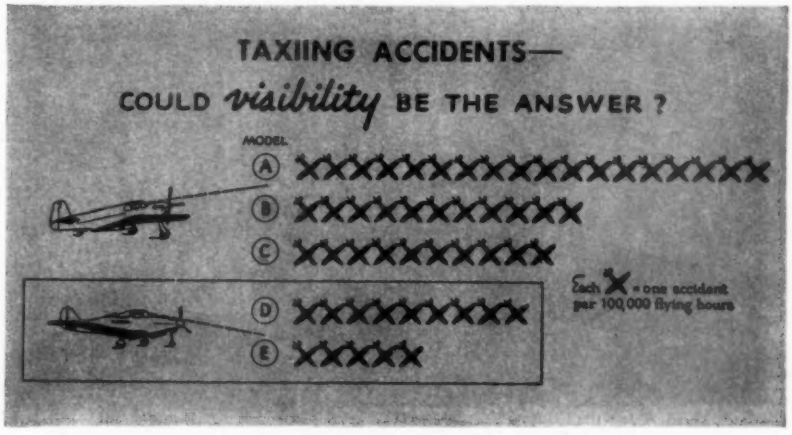
The conclusion that pilots were more sinned against than sinning has revolutionized much of the accident prevention activity in the Army Air Forces. Constant repetition of the same kind of errors was evidence enough that fundamentally it was the airplane that was wrong. The pilot is least susceptible to modification and redesign, the airplane you can change.

Here is an example of how a large number of confused pilots were finally exonerated after their confusion had cost the AAF over $10,000,000 in belly landings. It seems that there was an epidemic of mistaking landing gear switches for flap switches. Altogether a total of 457 major accidents occurred in a period of 22 months.

This is what would happen. On the landing roll the pilot would reach for the switch to raise the flaps but by mistake he would hit the landing gear switch instead, retracting the gear. The resulting predicament embarrassed a good many pilots, who were duly admonished not to do that sort of thing any more. But telling pilots not to confuse these switches proved to be an ineffective method of prevention. They went right on being confused.

Now the reason for the error was not

(*Continued on page 116*)



Conventional-geared aircraft have higher taxiing-crash rate than tricycle-geared.

SUPER

By FIORELLO H. La GUARDIA

Former Mayor, New York City

ON THE marshes of Long Island's Jamaica Bay, 25 minutes from Times Square and less than 40 air hours from the world's largest cities, New York City is building the world's greatest airport, Idlewild. With a total investment of nearly $200,000,000, this city is staking out its claim to a sizable share of the billion-dollar international air commerce expected within the next four years.

We are building this greatest of airports, not in the hope that some day there will be need for it, but because commercial aviation must have it the moment it is completed. In fact, the first three of 12 runways were to be ready for operation on December 2. By 1950 we expect to have at least 900 arrivals and departures per day and by 1955 we expect 360 movements per hour—as compared with 450 per day now at La Guardia Field.

Idlewild embraces 4,527 acres at the head of Jamaica Bay in the southeast corner of New York City. Over 1,100 buildings were demolished and removed from its path. Forty-one million cubic yards of sand fill have been placed on the airport site by large hydraulic suction dredges digging in the bay, and the new fill has already been graded to receive the concrete runways. When completed, the airport will have 12 tangential runways one to two miles long, an administration and control tower building covering 1,000,000 square feet, a double-shamrock loading platform accommodating up to 100 planes simultaneously, a 60-foot high tower. Forty hangars and other ground facilities for commercial aircraft of up to 150 tons will serve radar-controlled take-offs and landings of planes flying daily passenger, cargo, mail, and express schedules between the continents.

The new airport is to be used by all long-distance domestic services and all lines to foreign countries. Short-haul flights, with a radius as far as Chicago, will be handled at the present Municipal Airport at North Beach, which will continue to operate at full capacity. But it is conservatively estimated that national passenger and cargo flying will increase 300 per cent as soon as planes and personnel are available. Already schedules, at several per day, are being discussed to London, Paris, Vienna, Prague, Mexico City and points in Central and South America; and daily trips to Scandinavia, Russia, Spain, Portugal, Italy, Poland, Switzerland, Turkey, the Balkans, Greece, Africa and the Far East via Africa and Europe.

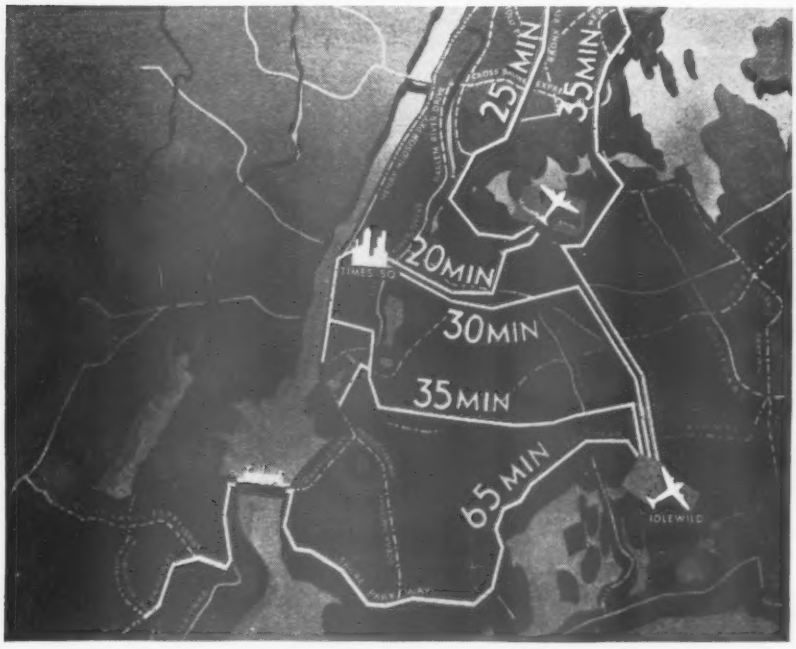
Once in full swing during the next decade, Idlewild should have a permanent staff of 40,000 to handle daily passenger traffic estimated at 30,000 persons, daily cargo movements calculated at 20,000 pounds of mail and 100,000 pounds of merchandise.

Whether these estimates are approached or exceeded is less important than the fact that Idlewild definitely puts New York in the center of the world's post-war air map and in a position to benefit exceedingly by world air trade.

Once we become the center for the world's air transportation, we intend to remain as such for a long time to come. For Idlewild is a symbol of a larger way of thinking about tomorrow, the Air Age.

(*Continued on page* 124)

This article was written by Mr. La Guardia before his retirement from the office of Mayor of New York City.—Ed.

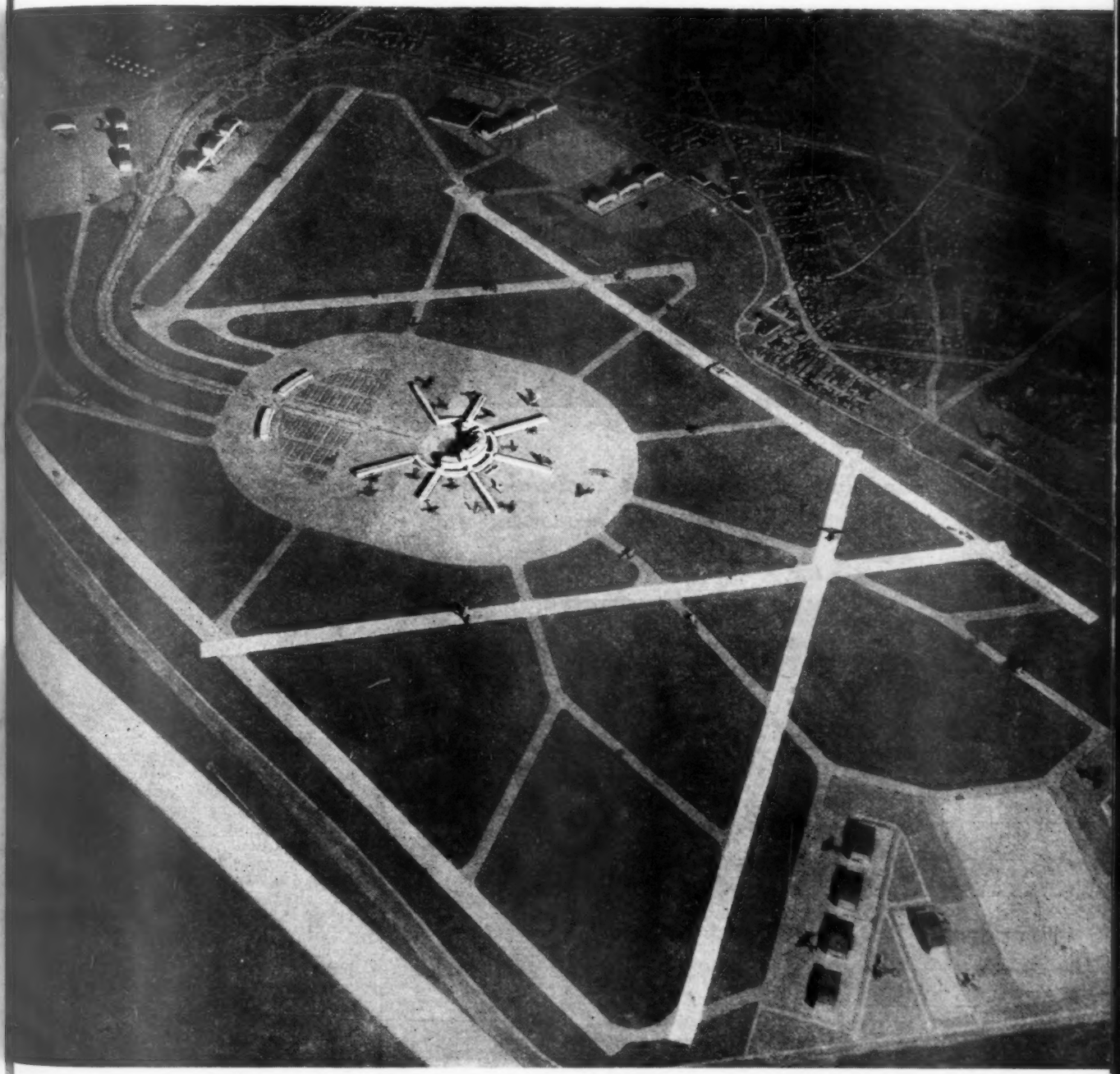


Two airplane silhouettes locate Idlewild, and La Guardia Field (top, right). Automobile travel time required to reach principal areas of New York City is indicated within highway outlines.

Maj. Elmer Haslett, New York director of airports, helped promote Idlewild project.

AIRPORT

With three runways already open, $200,000,000 Idlewild is on its way to becoming the world's busiest airport.



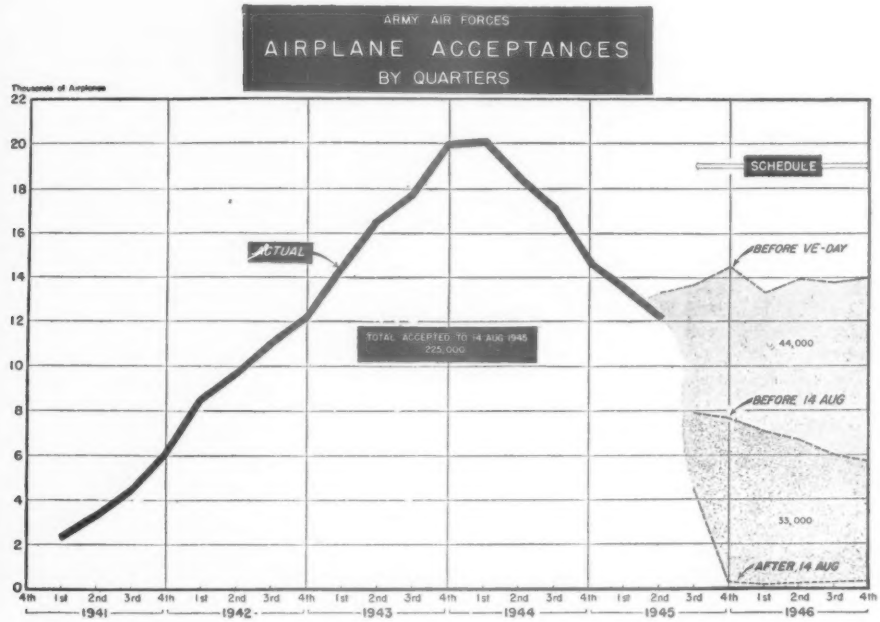
Plan of Idlewild looking from the south across Jamaica Bay toward midtown Manhattan. The seven-square-mile airport is being built on a fill dredged from the bay. Runways shown in gray are completed; gray center area houses a temporary administration building.

Aviation RECONVERTS TO PEACE

By

RICHARD O'CONNOR
Staff Writer, Los Angeles Examiner

Army and Navy cutbacks have left the aircraft industry with a gigantic reconversion headache.



Victories over Germany and Japan changed cutback program several times, adding confusion.

THE American aircraft industry was at the threshold of a new era as the war ended. It was leaving the reciprocating engine stage and embarking on gas turbines, and the various forms of jet propulsion. Research was also going forward on projectiles and guided missiles —weapons which were patterned after, but were more advanced than, the German V-2 bomb. But even the revolutionary fact of atomic power could not remove one almighty factor: *the atom bomb must be delivered to its target.*

Now in the midst of this beginning revolution, the aircraft industry faces serious problems—cutbacks, reconversion, the uncertain and changing future. Contract cancellations have really hurt. From early in 1944 through August 14, 1945, the total aircraft cutback was 106,700 planes which represented $22,150,000,000.

Chronologically, the 1944 cutbacks amounted to 30,400 aircraft with a total value of $4,850,000,000. The 1945 cutback, through VE-Day totaled 76,300 planes valued at $17,300,000,000.

Perhaps the best example of how the war's end caught the aircraft industry just entering the era of jet propulsion and gas turbines is Lockheed's P-80. The *Shooting Star* was the newest purely jet-propelled plane the United States had in production. Yet the *Shooting Star* is already obsolete as a military aircraft and other companies—including Lockheed itself—are planning and building superior fighter planes.

Through the continuing confusion over

Symbolizing extent of aircraft employment at peak, approximately 1,500 employees worked at drawing boards in single Douglas division.

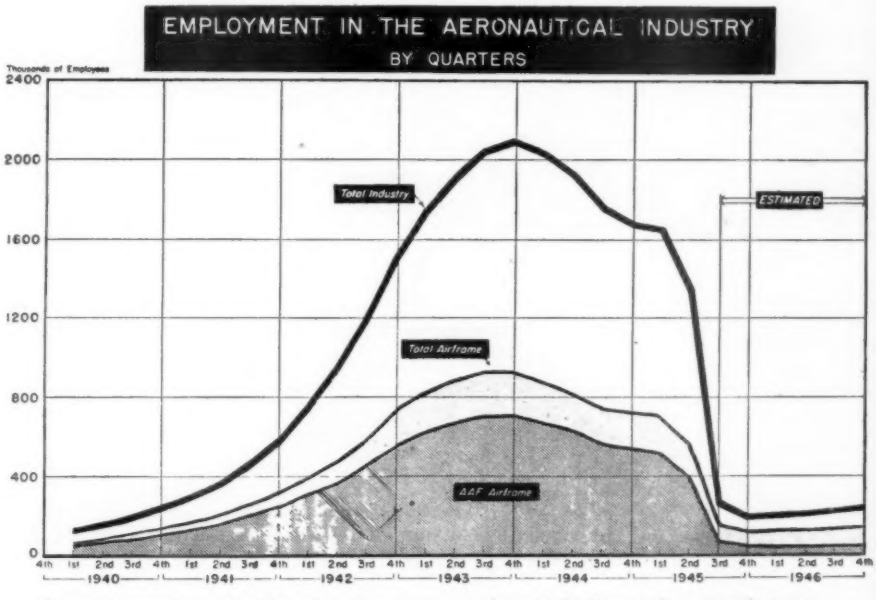
how deep the Army's and Navy's cutbacks eventually will extend and the chaos attendant on the sudden collapse of Japan, the achievements of the American aircraft industry are nonetheless spectacular. In five years from 1939 to 1945 it rose from 44th place among American industries to the world's greatest. In dollar volume airplane manufacturing rose from $279,000,000 in 1939 to $16,000,000,000 in 1944. At the time of Japan's surrender it had levelled off to the rate of slightly less than $11,000,000,000 annually. Envisioning the possibility of a sudden end to hostilities, aircraft manufacturers had believed they would be cut back to $2,000,000,000 in dollar volume of production in the 12 months after the shooting stopped. But the Army and Navy cancellations cut far deeper. Soon after V-J Day new schedules lowered production to the rate of $1,200,000,000—and later revisions reduced it further to around $500,000,000. An indication of the extent of these cutbacks is the AAF production figure of 9,117 planes in March, 1944; 4,784 in July, 1945, after Germany's defeat, and the latest estimate of 100 per month.

In a little over five and one-half years, from January, 1940, to August 14, 1945, the American aircraft industry had produced a total of 300,317 military planes, of which 274,941 were turned out from Pearl Harbor to the war's end. The industry's highest pitch was attained in 1944, when 96,369 aircraft came off the assembly lines throughout the United States. In March of that year 9,117 military aircraft were constructed—a record.

And from a total of 41 airplane, engine and propeller facilities existing in 1940, the industry mushroomed to 81 factories plus five plants operated on Canadian soil by 1943. Total floor space throughout the aircraft industry expanded from 13,115,000 square feet in January, 1940, to 167,391,000 square feet in December, 1944. From 1939 to 1944, the gross value of production facilities rose from $114,000,000 to $3,906,000,000.

In the span of years from 1940 to 1944,

(*Continued on page* 130)



Changes in employment picture dramatize degree of rise and decline in plane manufacturing.

LOCAL AIRLINES

Zimmerly's three Boeing 247D's fly 1,060 scheduled miles daily throughout Idaho.

By KURT RAND

Air transportation is coming to America's grass roots as the post-war airline boom takes shape.

THE nation's local airlines are engaged today in an ambitious post-war development program that acknowledges only one cloud on the horizon—the hard economics of making it pay.

Success of their venture will result in plane service for hundreds of municipalities throughout the United States never before touched by air carriers. Today, expansion is the by-word. And the area of activity ranges from Martha's Vineyard to Miami, from Maryland's eastern shore to the west coast.

From one point of view they are coming into a wide open field. Only 360 cities are served by the nation's scheduled interstate airlines—about a third of the country's population. Pending before the Civil Aeronautics Board are applications to serve 2,500 additional communities from coast to coast.

The framework of the future for the little airlines will be drawn by the Civil Aeronautics Board in its decisions affecting several hundred interstate and non-scheduled operators and by the liberality with which it issues certificates.

Pending before the CAB are nearly 500 applications for new routes or amendments to old ones and by far the bulk of the permits are being sought by small carriers which operate off the beaten path of the big trunk lines.

Kentucky's Bluegrass Airlines illustrates a rapid development of the small scheduled intrastate air carrier. Bluegrass made its first flight in March, 1944, with a single-engined Stinson *Voyager*. Today it has three twin-engined Cessnas flying approximately 1,000 miles a day and the figure is soon to be doubled.

The initial flights were between Louisville and Bowling Green, while round trips currently serve Paducah, Owensboro, Lexington, Bowling Green, Ashland,

Madisonville and Louisville. In addition, the following new routes have been requested: Memphis-Cincinnati-Covington; St. Louis-Nashville; Owensboro-Ashland via Cincinnati and Paducah-Ashland.

Company officials insist that Bluegrass will remain a local line despite its pending interstate applications and have no intention of trying to compete with the long-haul carriers. They point out that only Louisville was served by scheduled lines when the firm started operations little less than two years ago. Today, Louisville and six other Kentucky communities have scheduled air service.

For nearly a year and a half, Bluegrass maintained service with Stinson *Voyagers* and *Reliants* without an injury to passenger or employee and then shifted to twin-engined craft. The Cessnas are equipped with night-flying instruments and night flights will be inaugurated when navigational facilities are available.

Bishop M. Stuart and his two sons, Marvin and John, comprise the partnership management of Bluegrass Airlines. The company's fares are based on five cents per road mile, with passenger and cargo revenue increasing 75 per cent from June, 1944, to June, 1945.

Bluegrass Airlines' scheduled operations were possible because it is an intrastate airline where, so far, CAB economic regulations have had no authority.

The intrastate airline with the greatest amount of scheduled experience undoubtedly is Zimmerly Airlines, based at Lewiston, Idaho. Under the name of Empire Air Lines, Zimmerly also is applying for a Federal certificate of convenience and necessity over an interstate route.

As an uncertificated intrastate carrier, Zimmerly has operated 1,600 miles of routes since June, 1944, and at present is making scheduled daily flights totaling 1,060 miles between Coeur d'Alene via Lewiston, Boise, Twin Falls, Burley and Pocatello, to Idaho Falls. Boise, the largest city served, has only 25,000 population. Since June 24, 1945, Zimmerly has used Boeing 247D's, but has flown much smaller equipment in earlier operations.

From June 12 to October 22, 1944, for example, Zimmerly carried 2,237 passengers and flew 511,790 passenger miles on 539 flights. Of these, 84 flights were flown with a six-passenger single-engined Travel Air and the other flights were with three-passenger Cessnas. Of 428 scheduled flights, only 10 were interrupted and one cancelled by weather.

With a seven-cent fare, Zimmerly had revenues of $27.816 from June 1, 1944 to Sept. 30, 1944—an average of 14.77 cents per mile. Flying operations cost $17,719 or 9.41 cents per mile and ground operations were $11,306, or six cents per mile—resulting in a loss of $1,209 or .64 cents per mile flown.

Zimmerly's first Boeing 247D was put on June 24, 1945, and up to October 10, 1945, 721,250 passenger miles were flown — load factor of 59 per cent. In the three-month-period ended September 30, 1945, Zimmerly's income with the larger equipment was 38.144 cents per revenue mile, compared with total operational costs of 44.029 costs per mile—a net loss of 5.885 cents per revenue mile.

Zimmerly has been charging 6½ to nine cents per mile, depending on distance traveled. At 59 to 61 per cent load factors, Bert Zimmerly the owner, believes he could operate at a substantial profit if he could get a reasonable amount of mail pay—approximately 35 to 40 cents per pound.

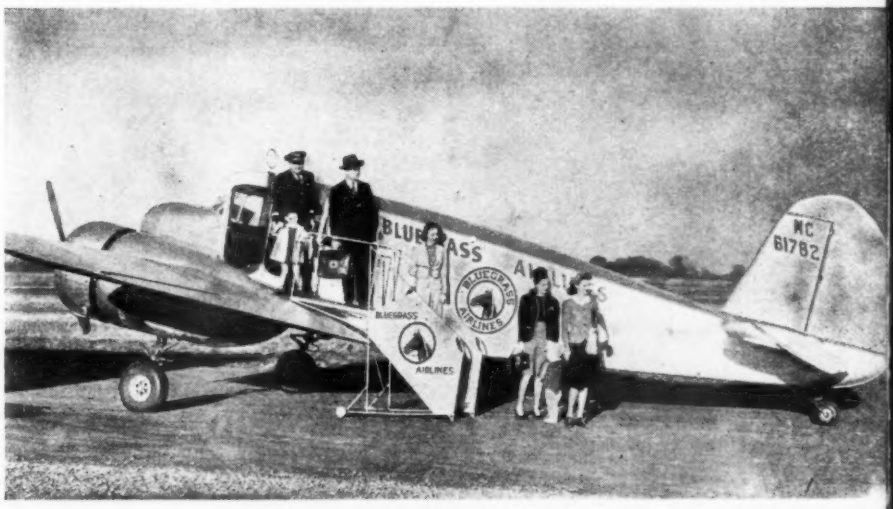
Zimmerly estimates it will cost $400,000 to start Empire Air Lines on an interstate basis, divided as follows: $25,000 for organization and route development, $57,790 working capital, and $317,210 in capital expenditures, including $182,400 for planes, $72,000 for engines, $12,000 for propellers and $50,810 for ground equipment. Empire's route would include the points in Idaho already served, plus Wenatchee, via Walla Walla, Wash., and touch Pendleton, La Grande, Baker and other points in Oregon between Walla Walla and Boise, Ida. It would also connect with the United Air Lines at Reno, Nev.

Idaho has a population of only 500,000 persons on 83,000 square miles. High mountain barriers impede surface transportation and distances are long. The special circumstances have been favorable—for example, Zimmerly's Boeings fly between Lewiston and Boise in 1 hr. 22 min. while the trip by train through Oregon and Washington requires 19 hours.

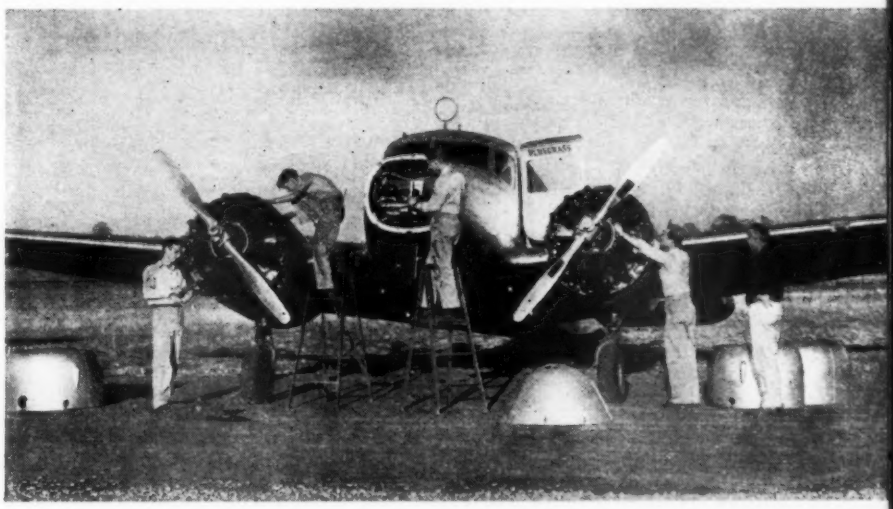
If Empire Air Lines is certificated, it will be able to carry mail and probably will derive enough extra revenue from that source to operate at a profit. As an intrastate airline, not certificated to carry mail, the Idaho company comes close to making expenses but is not quite able to do so.

There are a good many local airlines operating all over the United States. For convenience it would be well to distinguish between the types of service they offer.

1. SCHEDULED OPERATION. All scheduled airlines must have a Federal certificate of convenience and necessity if they operate



Converted Army Cessnas are used by Bluegrass Airlines, operating from Paducah to Ashland Ky. Pilots and ground crewmen are Army veterans, as is H. D. Ingalls, general manager of the company.



Maintenance checks are made before and after each Bluegrass flight Cessnas carry four passengers on comparatively short-haul runs, are completely equipped with standard instruments and radio.

interstate. Like Bluegrass and Zimmerly, however, they can maintain scheduled services if they confine themselves to *intrastate* operation.

2. NON-SCHEDULED-REGULAR. This is a service operated at other than fixed stated intervals over a specified route between fixed termini.

3. NON-SCHEDULED-IRREGULAR. A service operated at other than fixed stated intervals within a defined territory, including a service between a fixed base and points within a defined area but not over a specified route between fixed termini.

4. CHARTER. Services performed under an agreement for the exclusive use of a plane.

Only the first two of these classifications, probably, could be called "airline services."

Other "little airlines" include Otto Airlines in New Jersey, Ozark Airlines, Inc., which operates intrastate from Springfield, Mo., to both Kansas City and St. Louis with five-place Beechcrafts, and Summit Airways of Laramie, Wyo., and Ray Wilson, Inc., of Denver, Colo., which have been recommended for experimental feeder lines by CAB examiners. Another intrastate line which has been operating a scheduled service is Michigan Central Airlines, flying a daily round trip between Detroit and Charlevoix.

E. W. Wiggins, Inc., of Norwood, Mass., has already been approved by CAB examiners (though not by the Board itself as yet) for a three-year temporary certification for nine feeder routes in southern New England. In closely-packed New England, with highly developed surface transportation facilities, conditions are directly opposite those of sparsely populated mountainous Idaho, which have helped Zimmerly operate at 60 per cent seating capacity. The three-year certificate proposed to Wiggins is based on the idea that enough data would be provided at the end of that period to determine the long-run economic feasibility of maintaining such extensive local airlines.

That small companies do have difficulty getting on a profitable basis is clearly indicated by the experience of Zimmerly, and more recently by the suspension of operations of Trans-Marine Airlines, Inc., which flew from LaGuardia Field to Martha's Vineyard, Nantucket and Hyannis, Mass. Trans-Marine started daily service between these points on June 26, 1945, and suspended operations October 1. The company flew a Lockheed *Lodestar* and carried 1,613 passengers on 133 flights during the three months it was in operation.

Despite the favorable time of the year, with heavy summer resort traffic, the line just managed to break even, according to Hobart A. H. Cook, president and chief pilot. Trans-Marine flew a total of 27,990 miles, or 338,730 passenger miles. Direct operational costs were $18,000 and indirect costs $12,500—a total of $30,500. This breaks down to a cost of $1.09 per plane mile and nine cents per passenger mile.

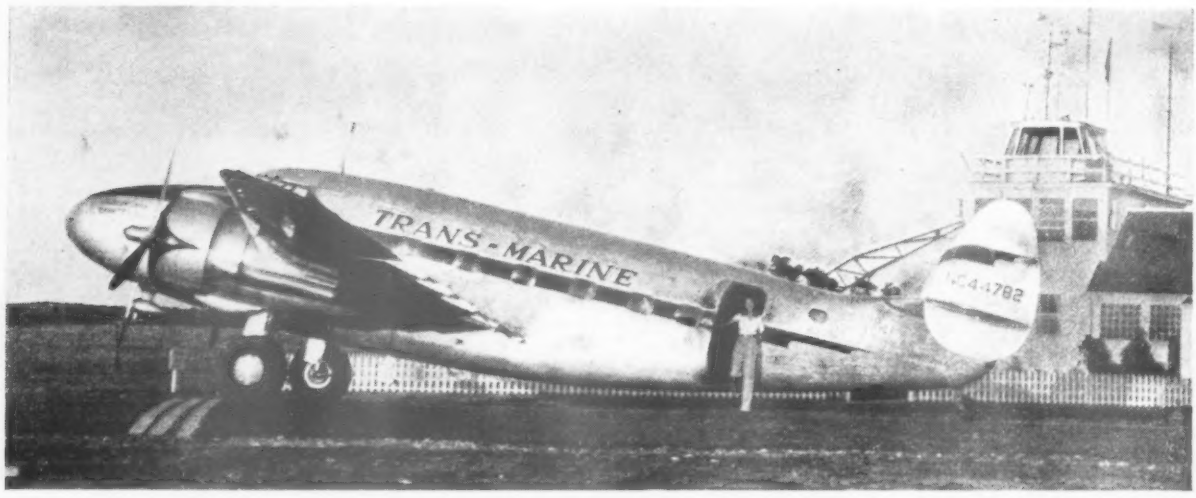
Nevertheless, Cook is optimistic about the future. "If the CAB awards us a certificate," he says—and this "if" seems to hold the crux of successful operation of little airlines as it did of the major airlines when they were getting started—"we hope to get four Douglas DC-3's which would take care of next summer's peak traffic. Winter traffic would be less and unneeded planes could be rented to other lines having winter peaks to meet, so absorbing their cost to Trans-Marine . . . If the certificate is granted I will be in a position to invite local (Cape Cod) capital to join with us."

Other little airlines also place their hope in CAB certification. One of them, Maryland Airlines, operates in CAB's home territory and proposes to use three Cessnas over a 587-mile scheduled interstate system. The proposed routes would serve Baltimore, Crisfield, Cambridge, Easton, Chestertown, Salisbury and Ocean City, all in Maryland, and Wilmington, Dover, Rehoboth and Georgetown, in Delaware. Maryland Airlines operated an interstate charter service last summer between Washington and Rehoboth.

Like Zimmerly, Maryland Airlines officials feel that terrain offers them a special advantage. Maryland's hilly surface, they feel, will save passengers much time. The company has discovered that 45 per cent of its passengers, flown heretofore between Washington, Easton and Rehoboth, have been women—many of them on shopping excursions to the capital.

The line operates three flights daily, with a $5 air fare to Easton as against a train fare of $4.89. The air time is only 20 minutes compared with four hours bus time, while rail service involves a change of trains.

Some of the first surplus Cessna *Bobcats* were converted by Maryland Airlines at a cost of about $2,500 including decorating, painting, insignia and certification. The company will have seven planes in all. Its paid-in capitalization is $100,000 and headquarters of the line are at Easton, Md., where $50,000 will be spent for hangars, $25,000 for administration buildings and $25,000 for shops. The line has been operating as a non-regulated, non-scheduled carrier.



Trans-Marine Airlines operated this Lodestar between Cape Cod and New York City during the summer, suspending operations during the winter. During the season they carried 1,613 passengers on 133 trips. Operating cost was nine cents per passenger mile.

The aim of small scheduled carriers—to obtain CAA certification—has already been achieved by Essair of Texas, which is a purely intrastate operation flying Lockheed *Electras* along a 678-mile circuit. After three months of operation, Essair reports that it "is doing much better than expected." Essair also has been approved for membership by the Air Transport Association, and probably not even now could be considered a local airline.

All preliminary indication is that CAB certification means the success or failure of scheduled operators. First, no company can operate a scheduled airline without CAB certification unless it flies solely within the boundaries of a single

(*Continued on page* 134)

Retraining THE G.I. MECHANIC

By PHILLIPS J. PECK

Staff Writer, International News Service, Washington, D. C.

AAF off-duty courses train mechanics to pass examinations for CAA's A and E certificates.

SOLDIER mechanics face a particular sort of reconversion problem—from B-29s to putt-putts. The ability to trouble-shoot a *Superfortress* does not imply ability to repair just any sort of a plane. Somewhere along the reconversion line the GI specialist must pick up the more general mechanical skills required by the Civil Aeronautics Administration for its aircraft and engine certificates.

Everyone concerned is quite certain that, once he has his A & E certificate, the discharged GI mechanic will find plenty of peacetime work to do. But the examinations he must pass to obtain such certificates are long and difficult and wartime work schedules have offered little opportunity for him to brush up on CAA regulations.

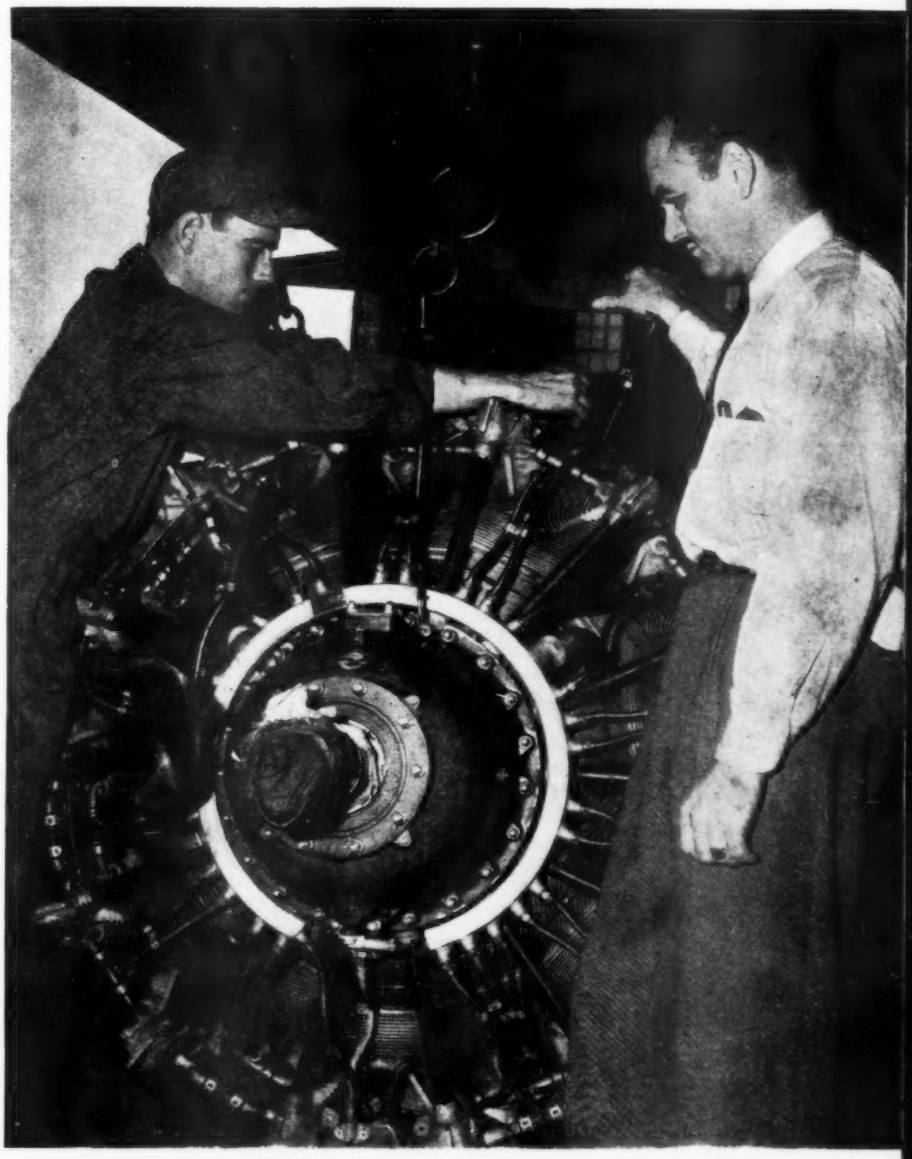
Recently, however, the AAF non-military education unit, headed by Lieut. Col. Leigh Baker, in co-operation with the CAA, came up with a noteworthy answer to the problem. It comprises a program of off-duty courses designed to prepare both officers and enlisted men for the CAA examinations. Already at 600 Army air bases throughout the United States this translation of GI training and techniques into civilian employment and security is under way. Many soldier mechanics about to be discharged may remain in service long enough to complete the six- to 12-week courses.

World War II was a war of specialists, and AAF mechanics were no exception; they couldn't do their jobs unless they had specialized training. Training of civil aviation mechanics, on the other hand, covers a wider range. The supplementary courses at the various air bases will be aimed at brushing up the soldier specialists on the over-all business of aircraft maintenance and repair.

"We'll give them what they are short of," explained W. D. Ford, chief of CAA's aviation mechanic unit. "It is not a case of completely training a man to be an airplane mechanic. They already know a lot and only need a push over the line."

"It's like going to college for three years and then quitting without the degree," Ford said in commenting on the status of those who do not take the training. "You have to have that degree to show you've got the stuff."

Training at Bolling Field, just outside Washington, D. C., is the "model" for the new program. First mechanic to win his own personal reconversion battle was M/Sgt. George F. Marshall, 23-year-old crew chief of Miami Beach, Fla. Marshall was given the CAA examinations along with 85 other Bolling Field mechan-



Under watchful eye of William Ford, chief, CAA aviation mechanic unit, M/Sgt. George S. Marshall, Jr., takes CAA mechanics exam. He was awarded certificate on day he left the service.

ics, passed them with flying colors and stepped out of uniform into a job as flight engineer for Pan American. Marshall waded through two six-hour, written examinations and passed practical tests which included pulling a cylinder and piston, checking and recording clearances of all parts for wear, and trouble-shooting an AT-6 which Ford deliberately had tampered with.

At first, the CAA exams were given to the soldier mechanics without benefit of advance instruction in order to determine what information they possessed and what additional coaching they would need to qualify for CAA certificates.

Ford reported that Civil Air Regulations and propellers were the two biggest examination hurdles. The average AAF mechanic, he explained, has dealt only with metal propellers and has little knowledge of the wood propellers which are so common to private planes.

Many of the original Bolling Field group missed out, however, on only one or two sections. Some passed the aircraft certification test but not the engine requirements. It was to assist those who fell short on the first try, and also to expedite the work of succeeding groups, that the off-duty courses were inaugurated—with enlisted instructors on the job morning, noon and night.

One-hour classes now are conducted five times a week. Except for class work on CAR, most of the students' time will be spent in the shop performing maintenance and overhaul functions on civilian-type aircraft. Subjects found to be most difficult are covered at length in the initial portion of the course and reviewed at the end. Each phase of the course is a separate subject so that the student who finds himself transferred to another field or is discharged from the Army can resume his studies without unnecessary repetition. Before starting a new phase, each student must pass a CAA-type practice examination of approximately 100 multiple-choice questions. Highly skilled mechanics with large point scores are advanced through the various sections of the course as rapidly as they can pass the check exams while men expecting to wait several months for a discharge proceed at a more leisurely pace.

Only skilled Air Forces personnel who were airplane and engine mechanics or flight engineers and who have had a minimum of one year's experience, are eligible for the courses in line with the idea of aiding already trained men rather than training beginners. Some 50 training films, previously prepared by the U.S. Office of Education with the co-operation of the CAA, are used in the classes. Ford has prepared a kit of CAA manuals for use by each student, including those on power plants and airplanes, and the necessary parts of the Civil Air Regulations. The work is sharply outlined with extraneous matter eliminated. A staff headed by Capt. H. B. Pickering, Air Technical Service Command, Middletown, Pa., prepared the instructor's guides.

Colonel Baker said the plans call for the establishment of a completely-equipped, CAA-approved airplane and engine repair shop at Bolling Field to give the soldier mechanics a concrete demonstration of how to set up their own post-war business. Three Piper *Cubs* already have been obtained for instructional purposes and letters have gone out to some 60 manufacturers seeking training suggestions and engines, tools and other training aids.

The educational venture to equip GIs for post-war careers will be extended to overseas AAF bases as rapidly as possible. The project already has been started at ATC bases in the India-Burma theater. Baker pointed out, however, that the overseas program necessarily will have to be limited to the written examinations for CAA certificates since there will be no CAA examiners on hand to conduct the practical tests. These will have to await the soldier mechanic's return to the United States.

First steps in the program were taken in December, 1944, when two officials of the CAA's General Inspection Division and Army representatives toured AAF mechanic training bases to determine to what degree Army training enables a mechanic to meet civilian requirements. As result of the tour, the AAF assigned Baker to the project. He worked with Ford, Pickering and Lieut. Col. Warner Corey, former CAA representative and now stationed at the Laurinberg-Maxton air base in North Carolina, to build the necessary refresher course.

GIs have had a very able ambassador in the person of Sgt. Howard L. Cook, now an instructor in jet propulsion at Chanute Field, Ill. Since the days in 1942 when he was a civilian instructor at Lockheed, Cook has heard the "gripe" of soldier mechanics that they were amassing a lot of aviation knowledge with scant prospects of being able to convert it into a civilian livelihood after the war.

"We have no standing with CAA," was the oft-voiced complaint. "When we get out we won't be able to change the engine on a Piper *Cub*."

Sergeant Cook, who has become a sort of traveling salesman for the mechanic supplementary courses, reveals that, "I got their point of view when I was pulled in myself." He wrote plans for mechanic training courses, dropped them in air base suggestion boxes, and bombarded higher ranking officers with the details. After V-J Day Cook was assigned to Bolling Field for active participation in the current project.

Cook feels not only that the program will boost the morale of GIs by offering them an avenue to civilian jobs but also that it will strengthen our national defense in years to come by keeping in aviation many trained men who might ordinarily return to other occupations.

Industry looks at the program from the immediate, practical approach of desperate manpower needs. When the Army recently turned over a number of *Skytrains* to five airlines for the transportation of re-deployed troops in the United States, an appeal immediately went out for trained mechanics.

The Army co-operated by passing on the "appeal" to its air bases for the attention of personnel about to be discharged. Several hundred applications

(*Continued on page* 134)

Ford and Lieut. Col. Warner Corey give CAA examination for A and E certificate to AAF mechanics at Bolling Field. In addition to two six-hour written examinations, students must pass practical tests.

AIRWAY INN

Visiting Waco circles for landing at Ernsberger farm. Nearly 800 planes and 1,200 flyers landed here for country dinners in the first six months of the airport's operation. Pilots from as far as Texas and South Dakota have stopped for a home-cooked Ernsberger meal.

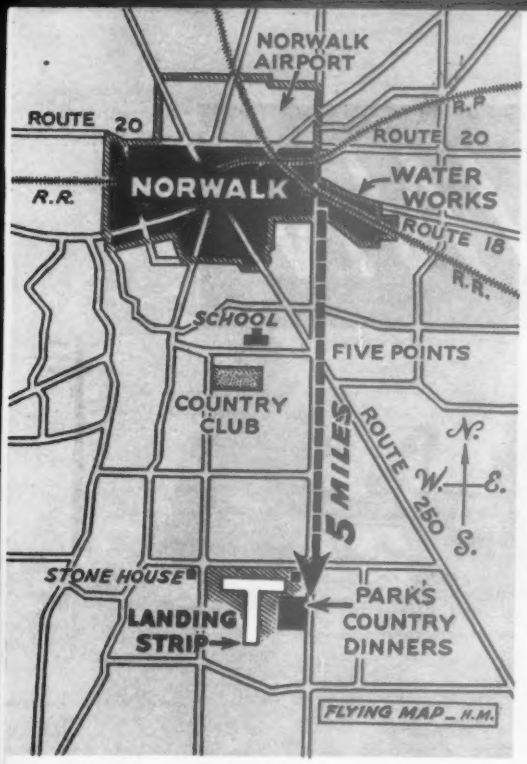
Park and Ina Ernsberger have proved that the way to a pilot's heart is through his stomach.

TELL an itinerant pilot of a good place to eat that's near a landing strip and he'll fly miles out of his way—just for food. Park Ernsberger found that out soon after he took up flying as a hobby. On trips away from his Norwalk, O., farm, he soon concluded that Mrs. Ernsberger was the world's most superlative cook when compared with the unskilled, disinterested, and often unclean characters who prepare the fare at the average airport restaurant.

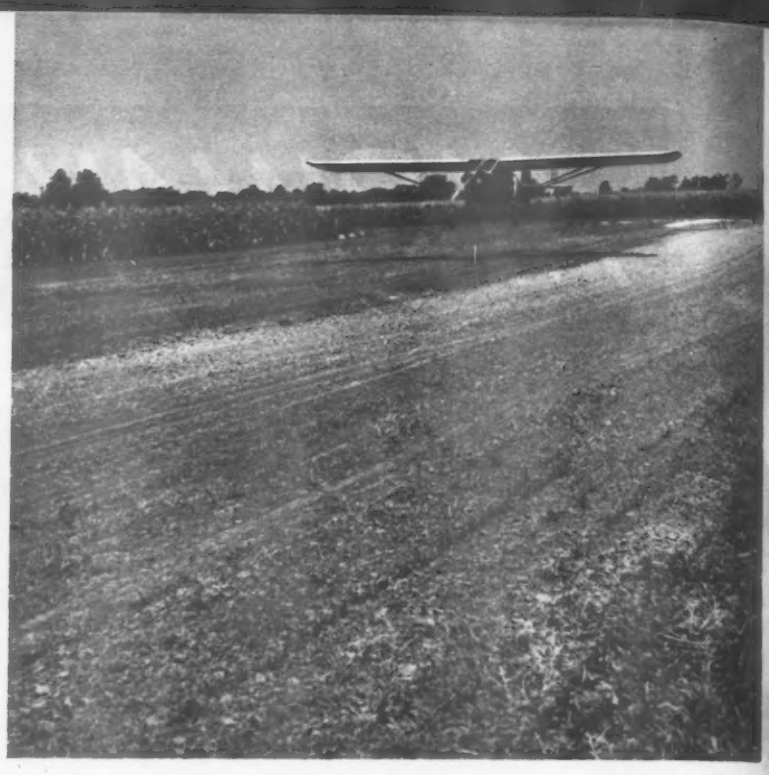
Ernsberger learned, too, that most pilots have paid exorbitant prices for bad airport food for so long that the mere promise of an airway inn that serves real farm-cooked meals leaves them in a mild frenzy to get there, get their planes on the ground, their feet under the table.

Just a year ago, Ernsberger asked his

Looking southwest over Ernsberger farm at east-west and north-south T-shaped runway pattern. The present airstrips are on only 30 of the farm's 120 acres. Bordering crops do not detract from the efficiency of runways, which have handled 43 planes in one day.



Map locates Ernsberger air park near Norwalk, O., an hour's flight from Cleveland, Toledo, Columbus.



Crop-bordered runways enhance back-to-the-farm character of this pilot's outing, attest practical economies that have governed combination of farming and flying.

wife if she would like to serve a real home-cooked meal to a few hungry pilot-acquaintances of his. She agreed—not knowing what she was getting into. At last report, Ina Ernsberger had served more than 1,200 persons who came in the more than 800 airplanes that had landed on the Ernsberger farm. Since last June, Park Ernsberger's airway inn idea has materialized into two existing runways, parking area for 40 planes, some overnight accommodations (with more planned), and—the pay-off—plenty of good food. His east-west runway is 2,900 feet long, the north-south runway offers an unobstructed 1,600 feet, while an additional 2,000-foot northeast-southwest runway now is being prepared. The CAA has recognized "Park's Airpark" officially; it appears on the newest maps.

T-hangars are going up, Ernsberger has taken on an Aeronca dealership (but his airpark will offer no maintenance service), the Shell Oil Company is installing pumps, and the Ernsbergers' original business of farming their 120 acres has begun to recede into the background.

Transient aircraft from as far away as Texas, South Dakota and Maryland have stopped at the Ernsberger farm. In one recent day 43 planes stopped by; there were 24 parked around the house at one time. Most of the visitors come in light-planes, although a number of planes in the Stinson and Waco class have landed there.

Ina Ernsberger's role as chef has taken on substantial proportions. She's serving an average of 130 meals a week, with business on the upgrade. The meals feature either steak, chicken, turkey or ham —they sell for $1.50. END

Full course meal costs $1.50. It may feature steak, chicken, turkey, ham. Popularity of the home-cooked fare has required that reservations be made in advance.

Farm hospitality that Proprietor Ernsberger extends to this flying guest is one reason for the success of his airway inn.

Huge steaks skilfully prepared by Ina Ernsberger explain why Ohio pilots are deserting hotdog fare of city airports.

Lazy siestas following an Ernsberger feast provide opportunity for far more intimate prop-wash sessions than does the city port. Farm can park 40 planes, has tie-down facilities for six. T-hangars for six planes are to be constructed soon.

PUSH-BUTTON WARFARE

By WILLIAM ROGER

Atomic missiles, guided by radio and television, soon will outmode our present concept of air power.

FOR years, a standard plot of writers of pseudo-scientific "amazing" fiction has concerned the mad scientist who invents a compound by which he can control the world or, failing that, destroy it. Invariably, in the plot there is a push-button which, at a touch, would set off the all-powerful material.

The trouble with the plot now is that in its main elements truth has overtaken fiction.

Shortly after the end of the war in Europe, two of Britain's leading air marshals were discussing the possible character of air war of the future. Glumly they admitted that, on the basis of the combined Allied and German technical knowledge and progress gained during the war, it would shortly be practical for two men sitting continents apart to press two buttons and destroy the world.

When that dire event will be possible is

for the future to decide. All that can safely be said now—within six months of this country's winning the greatest war in history, primarily through air power—is that the air forces that won that war already are obsolete. The chief witness for that statement is the leader of our own winning Army Air Forces, Gen. H. H. Arnold. In his final report on the wartime operations of the AAF, General Arnold employed a favorite term of the pseudo-scientific writers: "space ships," only the General didn't put it in quotes.

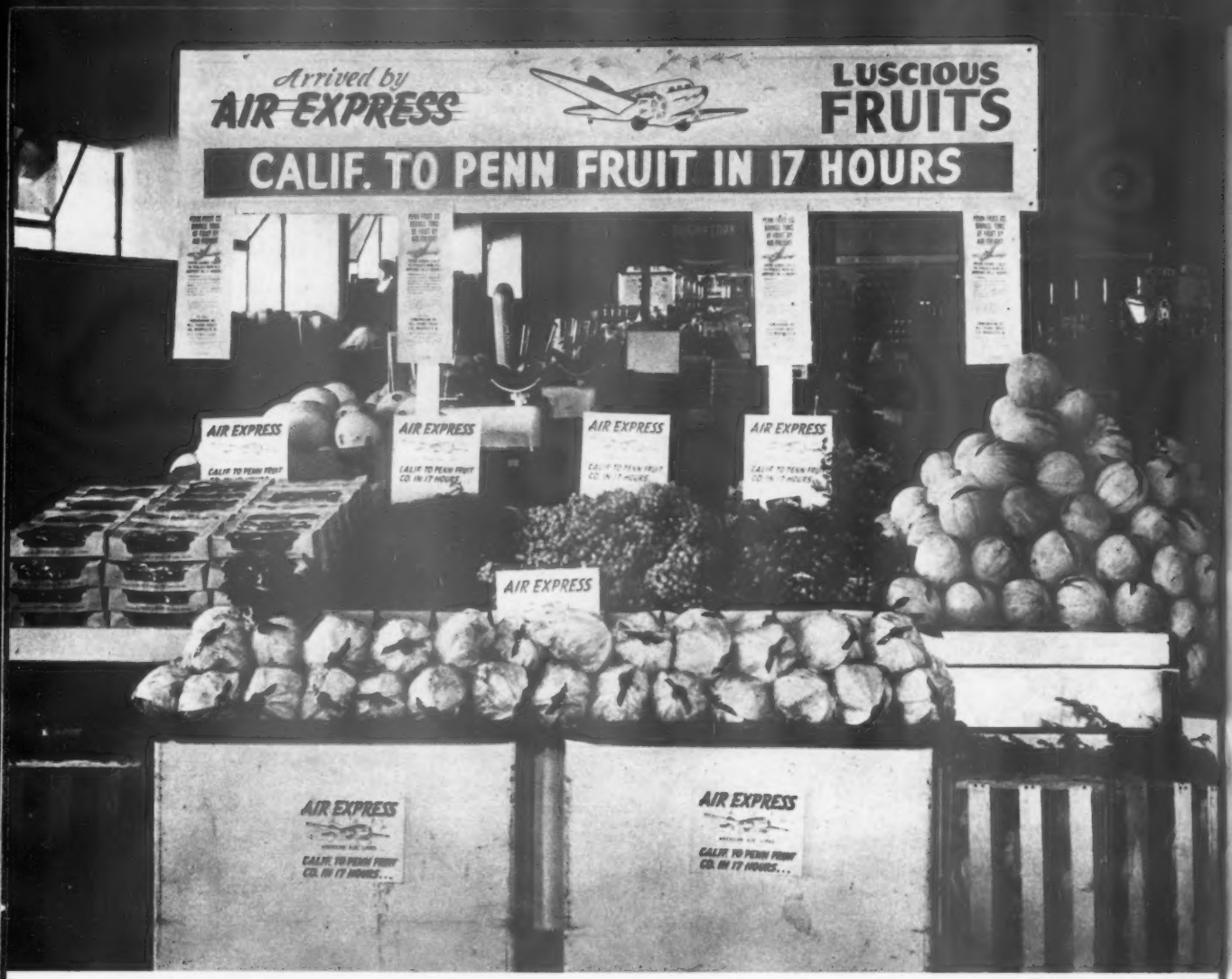
"The design of such a craft is all but practicable today," he declared. "Research will unquestionably bring it into being within the foreseeable future."

If achievements in the science of war as evidenced in the recently-ended hostilities are any gauge of what future wars will be like, push-button warfare is a certainty. Creation of one device—the atom bomb—has pushed the art of killing masses of human beings from the realm of fiction-writer fantasy into actuality. Atomic explosives are, therefore, the nucleus around which other lethal machines will develop.

Woven into this futuristic picture are missiles and aircraft guided by radio- and television-control, rockets, the proximity fuse, radar, varied forms of jet propul-

(*Continued on page* 106)

Future warfare will see atomic rockets hurled great distances through ionosphere at speeds of 3,000 m.p.h., reaching altitudes of 70 miles or more. Guided rocket-bombs, powered by better fuels, having more destructive warheads than were used with German V-2 (right), already have advanced air war to the push-button stage.



Garden-fresh produce, like this displayed in Philadelphia, is in demand despite higher prices resulting from air transportation costs.

FLYING HUCKSTER

Ralph E. Myers

THERE'LL be fresher ingredients for the nation's salad bowl now that Ralph E. Myers—rancher, shipper, iceman—has put wings on the huckster's wagon. Already, through regularly scheduled air shipments, Myers is supplying 54,000 pounds of fresh produce to American markets each week. And, so far as the immediate future is concerned, the prospective volume of airborne produce seems to be limited only by available planes, carrier co-operation, and the size of crops.

The Ralph E. Myers company alone ships 7,000 carloads of fresh produce a year by rail. The company's enterprising president is ready to put every pound of such shipments in the air once the limiting factors are mitigated. His pioneering has already made clear that much more than the advantage of fresh foodstuffs will accrue to American housewives through services of the flying huckster. The very circumstances of relatively expensive and high-speed handling will be an incentive to make air cargoes highly selected, premium crops. Most present waste will be trimmed away to save weight. Rare delicacies now available only at certain seasons may be purchased the year 'round.

It was largely because of Myers' insistence that air transportation of low-priced perishables was economically sound that members of the United Fresh Fruit and Vegetable Association appointed its first Air Transport Committee

Premium crops such as figs, melons, apricots can be flown in single-engined planes, like Stinson Reliant (above), from orchard areas to concentration points where they are loaded aboard one of Myers' transcontinental planes. Consolidated-Vultee Model 39 (below), with its 18,500-pound payload, was used in experiments which reduced coast-to-coast transportation costs from 84 to 26 cents per ton mile.

Asparagus being loaded in DC-3 (above) will not spoil when flown between 4,000-10,000-foot levels. Other vegetables and fruits need some such refrigeration as that used in United Cargoliner refrigerated "reefer" plane (below) which uses dry ice slabs in bags for cooling.

at the close of the all-industry air transport conference held in January, 1945. The committee's assignment was to compile a scientific answer to the question: Is it economically possible to ship fresh produce in commercial quantities by air transport? Myers, who had risen from a four-dollar-a-day laborer in his father's ice plant to head of a million-dollar shipping enterprise, was selected to head the six-man committee.

Under Myers' leadership the committee enlisted co-operation of the Office of Price Administration, services of individuals and organizations within the produce, aeronautical, petroleum and packaging industries, and the help of the United States Army Air Forces. Assisted by these agencies they conducted comprehensive, scientific experiments and tests on a nation-wide scale. Their findings admit formation of conclusions not heretofore possible on present or future air transport of low-cost perishables.

The experiments comprised shipment of 30 planeloads of fresh fruits and vegetables from California shipping points to 12 receivers in nine terminal markets—New York, Cleveland, Detroit, Philadelphia, Chicago, Atlanta, Milwaukee, Kansas City, and Denver. The shipments were made between March 1 and October 1, 1945, under virtually all weather conditions. They employed what was believed to be the best and most economical plane types then available for air freight traffic. Plane types used were the Douglas DC-3, payload 6,000 pounds, operated by United Air Lines on a scheduled basis; the Consolidated Vultee M-39, payload 18,500 pounds, operated on a non-scheduled basis under a contractual agreement by American Airlines, Convair and the Ralph E. Myers Company; and the Budd *Conestoga,* payload, 8,000 pounds, operated by the National Skyway Freight Corporation ("Flying Tigers") on a contract, non-scheduled basis.

Commodities shipped represented the majority of fresh fruits and vegetables available in California during the period of the experiment—grapes, strawberries, plums, apricots, peaches, pears, nectarines, figs, tomatoes, carrots, lettuce, asparagus, celery, broccoli, fresh shelled peas, peppers, cantaloupes, honeydews, honeyballs, Crenshaw melons, and a few other items.

During the eight months, shipments totaled 365,369 pounds, or approximately 183 tons. Of this total, the DC-3s carried nine loads grossing 56,233 pounds, the M-39 15 loads aggregating 261,136 pounds and the *Conestogas* six loads totaling 48,000 pounds. With exception of the first few shipments, all commodities were precooled before loading.

To assist in determining consumer reaction to airborne perishables, and to make possible a pricing technique which would help establish price levels at which such merchandise would move readily into consumption, a special regulation governing distribution and sales was formulated and issued by the Office of Price Administration.

Information and data on arrival and display condition, distribution, consumer acceptance and other factors upon which

(*Continued on page* 94)

By FRANKLIN D. WALKER

A SUMMARY of CAA's latest very high frequency radio facility plans for the private pilot warns radio manufacturers that VHF transmitters not equipped with sockets for five crystals may become very limited in usefulness after a year or so. CAA points out that, initially, private planes will use 131.7 megacycles for calling all airway communications stations and 131.9 megacycles for calling all airport control towers. By the end of 1946 it is expected that provision of two frequencies for calling airway communications stations and three frequencies for calling airport towers, will provide sufficient channels to handle a large volume of radio traffic.

Although only two crystals will be required immediately, CAA believes that manufacturers of sets should make provisions for adding three other crystals at a later date. CAA also suggests that manufacturers agree on both a standard crystal holder and the multiplicity of frequencies to obtain frequency output, so that additional crystals can be added with a minimum of trouble as they become necessary. The close proximity of the five frequencies should permit frequency changing by a simple crystal switch on the front of the transmitter.

Writing specifications for a VHF receiver for the private flyer is much more difficult than for the transmitter. The task is so complex from the standpoint of designing a low-cost tuneable receiver that it now appears certain that production of the standard 200 to 400 kc. receiver used before the war will continue indefinitely.

Among the problems confronting CAA and the Radio Technical Advisory Committee is the one concerning those private flyers who want only low-cost radio equipment for receiving voice signals alone, and don't want to pay the additional sum necessary to obtain directional guidance provided by VHF ranges and localizers. CAA suggests that this type of pilot be equipped to receive both voice transmissions on the VHF range channel and the localizer channel. Such a receiver would have to be capable of covering the entire 108 to 122 megacycle band, within which are localizers, ranges and control towers, and would have to contain 70 frequencies (the number in the 108-122 band). A tuneable receiver is the only solution. The design of a low-cost, light-weight receiver with adequate frequency stability, dependable dial calibration and no frequency drift constitutes a formidable problem, CAA reports. "It is problematical whether such a receiver can be designed in time to be available for the immediate market," says CAA.

If it cannot, a receiver covering the 200-400 kc. band must be offered in the interim for use with the VHF transmitter, according to CAA, which says the use of a VHF transmitter appears advisable regardless of whether the receiver is for VHF or the 200-400 low frequency band. Superior performance of the VHF transmitter, adds CAA, in comparison with the 3105 kc. transmitter generally used by the private pilot, makes the wisdom of a VHF transmitter evident.

If and when a low-cost VHF receiver is built for those who want only voice reception, CAA recommends that the manufacturer provide a circuit for attaching a converter unit that will enable the pilot to use the omni-directional range. Reason for this suggestion is that the change-over from the two visual-two aural VHF range to the omni-directional type will take place rapidly. Until the conversion is completed, however, all localizers may be modified to permit their use with the same receiver converter required for the omni-directional range. All CAA control towers will be changed over to civil VHF frequencies within the next few months but they still will be equipped to transmit in the 200-400 kilocycle band as well.

Conversion of present CAA equipment transmitting on military frequencies is almost complete. Maintenance of VHF facilities for service aircraft will be accomplished through use of VHF transmitters which both the Army and Navy are providing CAA.

Washington Conference

About everything said at the first joint private flying conference in Washington had been said many times before, particularly as it applied to the aircraft manufacturers' apparent willingness to offer, as post-war products, planes of pre-war design which do not provide the safety, performance and utility essential to the rapid growth of peacetime personal flying. The industry and CAA were sharply criticized, as were less progressive fixed-base operators. Most of the criticism was destructive and unanswered.

Most serious indictment of CAA was handed up by Lieut. Col. C. B. Sproul, Chief of the Technical Division, USAAF, who declared the Government's low approach system is far too difficult for the average private pilot to master, requires too much equipment and is obsolete. He suggested it be replaced by a modified GCA (ground controlled approach) system under which the pilot would require only two-way communications and confidence in a well-trained ground station staff. Colonel Sproul asserted that two experts on the ground can, with GCA, land planes at the rate of one every 30 seconds. His comment on the CAA system was: "I have yet to find a man who can fly it."

Robb C. Oertel, Airports Division, Standard Oil Company of New Jersey, disclosed that petroleum companies stand ready to back fixed-base operators who are unable to obtain credit from banks or private capital sources. He suggested that hangar and other airport equipment manufacturers be invited to help along sound business ventures in the private airport field.

Jerome Lederer, chief engineer, Aero Insurance Underwriters, whose company recently announced reductions as high as 50 per cent in premiums for personal aircraft owners and service operators, advocated a co-operative educational program aimed at a drastic reduction in personal aircraft accidents. Among other airplane improvements he recommended redesigning of instrument panels and cabin interiors so that controls and other fittings cannot become weapons against the pilot during a crackup.

Most refreshing address, particularly to those who have attended many "Hurrah For Us" sessions of private flyers, was delivered by Elizabeth Gordon, managing editor of *House Beautiful* magazine, and a student pilot with 45 hours. She struck out boldly at the dirty, badly-operated fields; predicted department store selling of planes (see "Planes Over the Counter" in FLYING, January, 1946) would succeed unless fixed-base distributors quickly adopted modern merchandising practices; called for simple English to replace aviation jobberwocky in manuals and other flight literature; advocated the use of working models to demonstrate what happens when airplane controls are moved; and denounced anything more complicated than a two-control plane.

(*Continued on page* 127)

FOG

EDITOR'S NOTE

This is a condensation of the Navy booklet entitled "Fog," prepared by the Training Division, Bureau of Aeronautics. It is one of the Navy's aerology series, reprinted here because of its simple, lucid and non-technical presentation.

Reducing visibility to the zero point is fog's greatest menace to flight. All pilots should know how, why and where fog forms—and how to avoid it.

NO ONE can prescribe the safest method of flying in fog. It has always been a hazard to aviation, and until instrument flying is perfected far beyond its status of today fog will continue to haunt any pilot who attempts to fly around or land in it.

Fog, in itself, is a menace only in that it obscures visibility. And since airplanes must land, and airports without obstructions of some nature are few and far between, fog creates a hazardous situation.

This sets forth rule No. 1: if your intended airport is fogged in, the logical thing to do is to continue on to your alternative airport—which is one of the best reasons for always selecting an alternate landing base when flying cross-country.

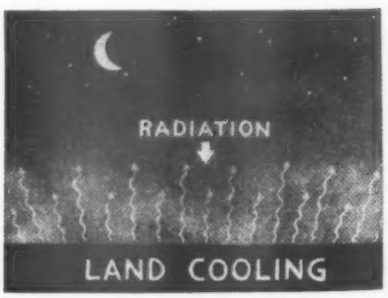
Equipment to de-fog airports is still experimental as far as civil operations are concerned. Therefore, the greatest precaution available is to learn what conditions lead to the formation of fog so that you may take advance measures and plan accordingly.

Perhaps the surest safety device in combating fog is a sufficient supply of gasoline to get you to an alternate airport where the visibility will permit a safe landing from *any point* on your proposed trip. It rarely pays to circle over an airport waiting for fog to lift, for if it remains or gets worse you may find yourself directly over an unseen field, out of fuel, and only the "sweat-and-pray" method of getting down.

Fog may be defined as a cloud resting on the earth's surface. In the usual sense we mean by that, a visible condensation in the atmosphere of sufficient density to interfere with aerial navigation. Fog varies in depth from a few feet to many hundreds of feet. Its density is variable, resulting in visibilities from near zero to as much as 1,100 yards. Above this limit it is called haze.

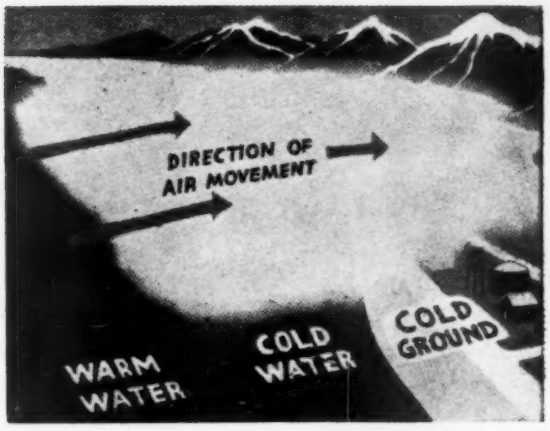
Fog consists of visible water droplets,

Warm air flowing over cold land or water surfaces forms advection fog.



Radiation fog forms on clear nights from heat released by cooling land.

In daytime, sea fog forming from warm, moist air being carried to cooler water near coastline by on-shore winds is dissipated by heat from land which has been warmed by sun.



At night, when the ground is cooler, sea fog does not tend to dissipate and moves considerable distances inland. Obstructions, such as hills or mountains, stop its movement.

or ice particles, suspended in the atmosphere. It differs from other clouds in that it exists on the ground or on the surface of bodies of water, while other clouds may be thousands of feet aloft. It also differs from rain or mist in that its water or ice particles are suspended and do not fall earthward.

Forecasting of fog is frequently difficult because, in addition to knowledge of the meteorological causes of fog formation, it is necessary to have a thorough knowledge of local geography and topography. A slight air drainage may be enough to prevent fog formation, or a quick shift in wind direction may cause fog to cover an airport suddenly.

Fog has this unpleasant characteristic: when you are above it, you can't distinguish it from a layer of stratus clouds. You may descend through a layer of stratus clouds and find a ceiling of several thousand feet and visibility of several miles when you break out underneath. But if it were fog, when you break out underneath your ceiling may be somewhere under the ground.

Until you have logged many hours as a "weather pilot," you had better adopt this as your definition of fog:

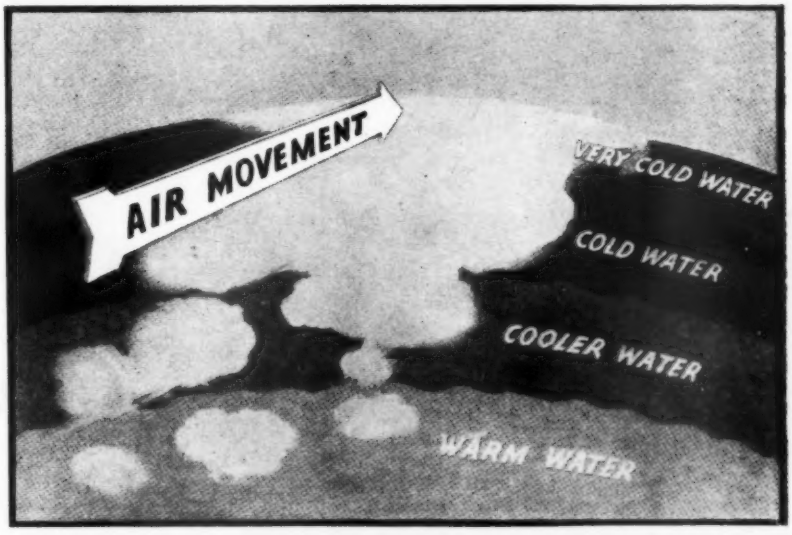
It is a strong reminder that we can't (as yet) control the weather.

It is the danger signal that says, "proceed to the alternate airport without further delay. And always keep that alternate airport in mind."

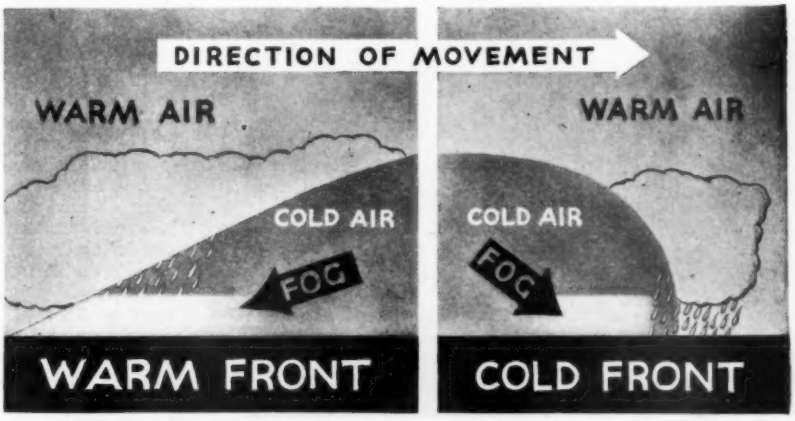
It is the best argument for having an adequate fuel supply.

How does fog form? As an analogy, consider a cup of coffee. If it's hot you can dissolve a lot of sugar in it but if it's cold the sugar will resist dissolving. The atmosphere may be considered as a solution of water vapor in dry air. The amount of water vapor which the air can hold in solution depends upon the temperature. The higher the temperature, the more water vapor the air can contain. For any given amount of water vapor, therefore, you can reduce the temperature just so much without condensing out liquid water particles. If the temperature

(*Continued on page* 102)



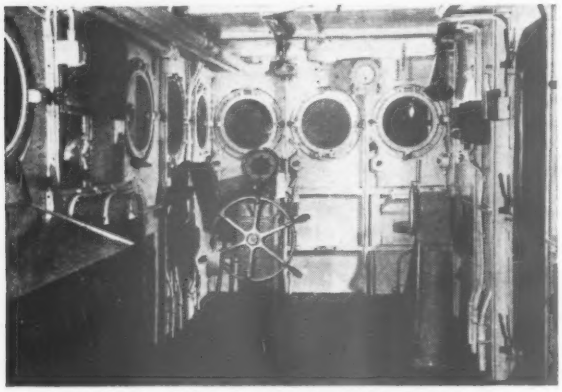
Movement of tropical air masses from lower to higher latitudes forms tropical air fog. This type of fog can resist dissipation from high winds, covers an extremely wide area and makes visibility very poor. It is often accompanied by a heavy mist and drizzle.



Frontal fogs may be in advance of, following, or accompanying a front. Warm front fogs are most hazardous, cover large areas, remain longer than short-lived cold front type.

Navy equipment goes ashore to be trucked to a Government warehouse. Carriers will remain unaltered structurally until peacetime duties are determined, or until they are junked.

Wolverine's "island" contains bridge (top), navigator's quarters and radio equipment.



Pilot house of the Sable has been stripped of all but some bare, essential equipment that came with the original excursion ship.

Sable's executive and engineering officers sit alone in empty wardroom. Doors at right and rear opened into officers' cabins.

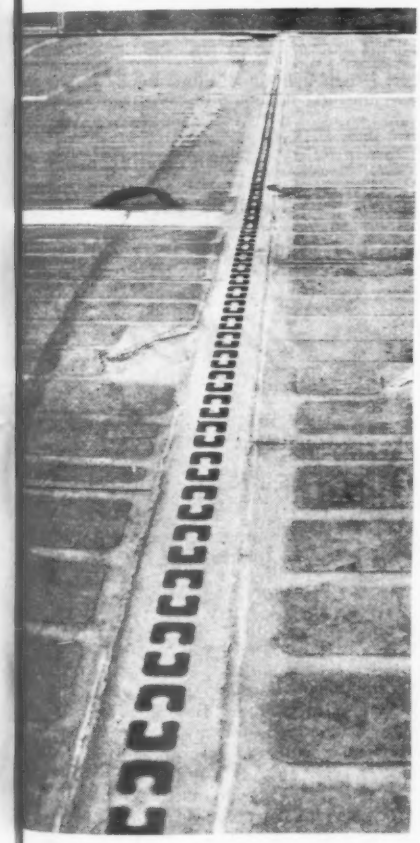
Want to Buy a CARRIER?

The Navy's only fresh-water carriers are for sale at Chicago.

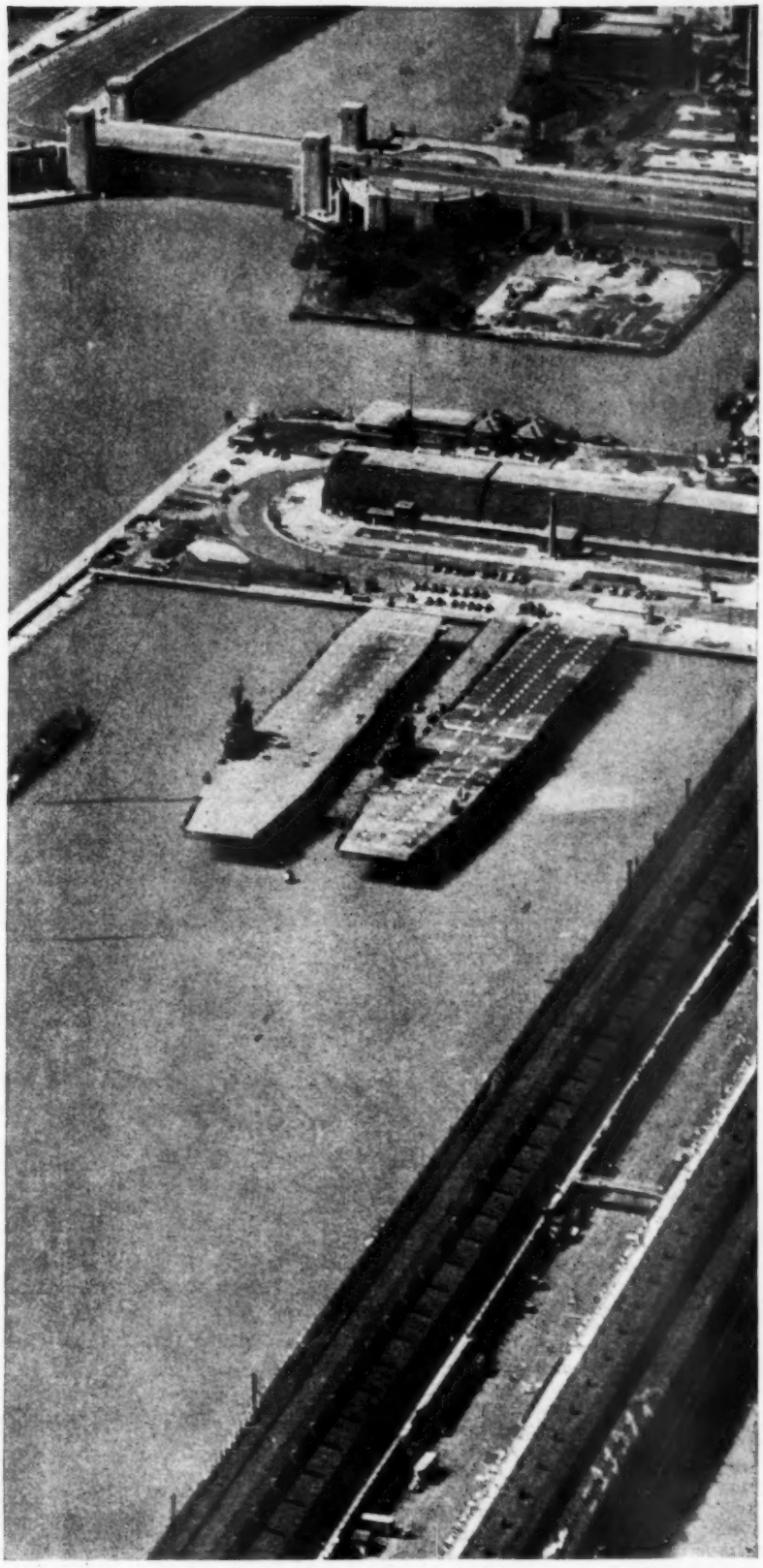
TWO aircraft carriers, the *Wolverine* and the *Sable*—like many of the Navy pilots they trained—are looking for civilian jobs. Decommissioned in November, they have been turned over to the War Shipping Administration, an agency which will gladly supply information as to how and when you may submit your bid to buy a carrier. Offered first (as a matter of routine) to the original owners, they were refused—the cost of reconversion to their pre-war passenger-liner status was too great. But you'll have to bid more than scrap prices. Automobile manufacturers and railway men think the ships may have a future as ferries—and one entrepreneur contemplates a mammoth moonlit dance floor and the world's largest floating night club.

Once the *S.S. Greater Buffalo* and the *S.S. Seeandbee*, two of the largest passenger liners of the Great Lakes fleet, the coal-burning sidewheelers doffed their superstructures and luxury equipment to don flight decks (for the *Sable*, the first steel deck ever used on a Navy carrier). On those decks 136,428 landings were made in the qualifying of 17,820 pilots—almost half the total number assigned to the fleet. And they readied hundreds of deck-crew members and dozens of landing signal officers. The project saved time and money that armament and escort vessels for coastal operation would have required.

Superstructure changes were so extensive that cost of reconversion is prohibitive.



Secret arresting gear (note cable marks at left) is gone. Tiedown strips remain.



The Wolverine (left), commissioned April 10, 1942, and the Sable, commissioned May 8, 1943, at Navy Pier in Chicago. Both ships were decommissioned November 10, 1945.

Correct speed is essential to this Stinson's safe execution of a sharply-banked turn. If speed were too slow, plane would stall. If too high, structural failure could result.

Maneuvering in Safety

By H. R. FOOTTIT

All aircraft have safe speed ranges governed by simple aerodynamic laws. Here is how they apply.

"WE HAD just pulled out of a fast dive and were starting to zoom up into a loop when I glanced at the left wing and saw pieces of plywood covering ripping away. There was a dull thud as the wing wrenched loose at the fuselage attachment and appeared to fold up and float over the cockpit . . ."

This extract from the testimony of a military pilot who parachuted away from his airplane after a structural failure of the wing is typical of many accident investigation reports. In 1943 the Civil Aeronautics Board reported 40 structural failures in flight during non-transport flying operations, with 13 persons killed and five seriously injured. Of these 40 accidents, 26, or 65 per cent, occurred during instructional flying. The majority were due to wing or control system failures.

Some structural failures could, no doubt, be avoided with more careful handling of the airplane. Though the physical effect of excessive acceleration, or "G", is well known, not so well known is the fact that there is a cruising speed range where excessive G sufficient to damage the aircraft structure is impossible to attain. Within this speed range the airplane may be handled as roughly as the pilot wishes. Before a wing can be wrenched loose or any structural damage can result the aircraft will merely stall.

The low speed end of this safe speed range is the airplane's normal stalling speed. The maximum high speed at which the airplane can maneuver in structural safety is the "safe maneuvering speed." This speed can be calculated

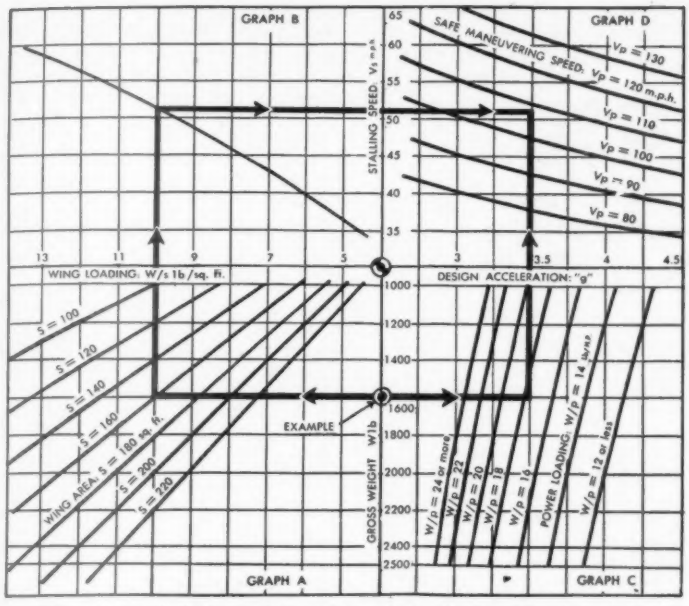


Figure 1. Graph A shows plot variation of wing loading; Graph B, variation of flaps-up stalling speed; Graph C, CAB requirements for minimum design acceleration in terms of "G," and Graph D, safe maneuvering airspeed.

readily when some of the basic design characteristics of the particular airplane are known. However, the safe maneuvering speed can be expressed in graphic form so it can easily be read off a standard graph suitable for any aircraft with sufficient accuracy for all practical purposes. To limit the size of the graph, only planes in the lightplane and training aircraft class, with gross weights between 1,000 and 2,500 pounds, will be considered in this study.

The safe maneuvering speed and its relation to the basic structural design of the aircraft, a typical light training plane with the characteristics shown in the table, will be used as an example. For this typical airplane the maximum permissible maneuvering acceleration is shown in Figure 2. This graph, similar to what is commonly called a "flight envelope," merely shows the permissible G at any airspeed indicator reading.

Since the borders of this flight envelope are the maximum accelerations that the aircraft designer anticipates in the design of the airplane structure, in no case must this design G be exceeded or the structure will be bent or broken. For example, if this typical lightplane was pushed into a dive to 160 m.p.h., the pilot must not pull out with more than 3.47 G acceleration or structural damage will result.

The flight envelope of Figure 2 illustrates the greatest upward acceleration permissible in flight maneuvers. The maximum downward acceleration has not been shown since extensive flight tests have proved that downward G of any magnitude is rarely encountered in normal flying.

It can be seen that the flight envelope is cut off at the "flaps up stalling speed" (51 m.p.h.), since the airplane will not fly with the flaps up below this speed. At the high speed end of the envelope the cut-off occurs at the maximum permissible diving speed (180 m.p.h.), since this speed is fixed by the aircraft manufacturer and should never be exceeded.

The curved portion at the left of the envelope shows the maximum G that can be realized in a "high speed stall." It should be noted that this acceleration is theoretically the *absolute maximum*, since the airplane will stall on reaching this G and the acceleration (and therefore the load on the structure) will decrease. This curve can be derived from considerations of the maximum lift and weight of the aircraft at any airspeed. From this derivation it will be found that the points on the curve are given by the equation:

$$A \text{ (in terms of } G) = \left(\frac{V}{V_s}\right)^2 - 1.0$$

Where A is the acceleration expressed in Gs, V is the particular indicated airspeed selected, and V_s the indicated stalling speed. If it is desired to find the maximum G that could be achieved in a high speed stall at 100 m.p.h. in the aircraft of Table 1, it would be calculated from the above equation as follows:

$$A = \left(\frac{V}{V_s}\right)^2 - 1.0 = \left(\frac{100}{51}\right)^2 - 1.0$$
$$= (1.96)^2 - 1.0$$
$$= (3.84 - 1.0) = 2.84G \text{ at 100 m.p.h.}$$

The straight line at the top of the flight envelope (3.47G) is fixed by the Civil Aeronautics Board as the minimum acceleration that this airplane structure must be designed to withstand. This minimum design G varies with the gross weight and power loading of the particular aircraft as shown in Figure 1, Graph C.

From the flight envelope it is apparent that if this particular airplane is flown at any airspeed between stalling at 51 m.p.h. and 108 m.p.h. the structure can-

(*Continued on page 122*)

AIRPLANE CHARACTERISTICS		
GROSS WEIGHT	W	1600 lb.
GROSS WING AREA	S	160 sq. ft.
RATED ENGINE HORSE-POWER	P	90 H.P.
POWER LOADING	W/P	17.8 lb./H.P.
INDICATED STALLING SPEED, FLAPS UP	Vs	51 m.p.h.
MAXIMUM PERMISSIBLE DIVING SPEED	Vg	180 m.p.h.

This table lists plane characteristics and key symbols used in explanatory formulas.

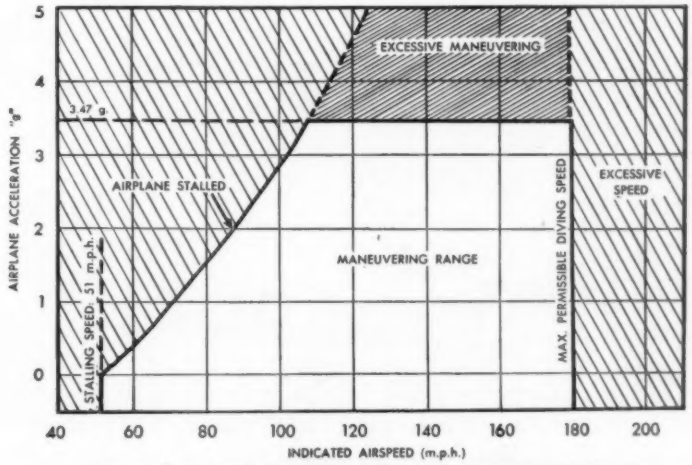


Figure 2 shows greatest upward acceleration permissible in flight maneuvers. Minimum stall speed of 51 m.p.h. is based on flaps-up flight.

By Maj. OLIVER STEWART

British Authority, Editor of Aeronautics

SHOULD the rules governing the determination of world's speed records for aircraft be altered? That question has been under intermittent discussion ever since Britain's Gloster *Meteor IV* (two Rolls-Royce *Derwent* gas turbines) set the record of 606 m.p.h. at Herne Bay, England, on November 7, 1945.

Your correspondent was at Herne Bay for both the preliminary trials and the record runs. The course was over the sea, close to the promenade. The rules require that the course measure three kilometers, approximately 1⅞ miles (all world record measurements are in the metric system) and that there shall be an entry run of 500 meters (1,640 feet). The aircraft must at no time exceed 75 meters (246 feet) in the measured section or the entry run.

These rules are intended to prevent diving and to insure that a true measure of the aircraft's maximum speed capability is secured.

Pilot's Views

It was argued that flying near an altitude of 100 feet at top speed was unnecessarily dangerous and that the rules ought to be altered to allow the record to be taken at greater heights.

Discussing this view with the pilot, Group Captain Wilson, and with the radar experts who were there to direct a new form of radar timing, your correspondent found that radar would probably be able to do accurate timing at heights of 2,000 or 3,000 feet but that a much longer base —one radar man proposed 50 miles— would be needed.

Record Holder Wilson, on the other hand, expressed himself as satisfied with the rules as they were. He judged it as important to demonstrate that a plane can fly as fast under good control close to the ground as it can at high altitudes.

So far no application for a change in the rules has been put in to the International Aeronautical Federation by Britain.

Shock Stall Characteristics

The whole thing really depends upon the behavior of the aircraft at the shock stall, when the local speed of the air flow nears the speed of sound (about 763 m.p.h. at sea level at 15° centigrade). Some planes put their noses up as the shock stall develops—some put their noses down. The pilot can do nothing about it.

The *Meteor*, Group Captain Wilson said, puts its nose up at the stock stall, so that had the aircraft become fully shock stalled during the record runs, the pilot would probably have been able to recover without hitting the sea.

But at the speeds achieved—the fastest run recorded being 983 kilometers or 611 m.p.h.—only parts of the *Meteor* (for instance, the area over the wind screen) were shock stalled.

Advantages of utilizing the Federation Aeronautique Internationale rules are that they put all speed claims into one perspective.

Some people in Britain believed that the Lockheed *Shooting Star* (P-80) was the fastest aircraft in the world until the record was taken by the *Meteor*. Now no one here will believe that any aircraft is faster than the *Meteor* until it has been proved so under FAI rules. That is one of the advantages of standard rule. It establishes the truth.

Novelties

The *Meteor* world-speed record was the first in which compressibility troubles were encountered to any noticeable extent. It was also the first jet record in which the thrust available was more than that required.

The Rolls-Royce *Derwent* jet engines were both governed. The pilots had their throttle levers fully open but the engines were governed to give less than the full thrust of which they were capable.

Thus all the responsibility fell on the airframe. It was the shape and structure of the plane which determined the top speed. The Gloster *Meteor* aircraft was designed by W. G. Carter of the Gloster Aircraft Company, which is one of the Hawker Siddeley group

Civil Air Policy

Lord Winster, Minister of Civil Aviation, made his long awaited statement about British civil aviation policy on November 1 in the House of Lords.

He said that public ownership was to be the guiding principle. It follows that British airlines will be state airlines when the government's plans become law.

Your correspondent, who has seen two attempts at state operation-ownership (when the state used the Royal Aircraft Factory and later when it built the airship R-101) is opposed to the present doctrine. He does not believe that it will lead to efficiency in British airline operation.

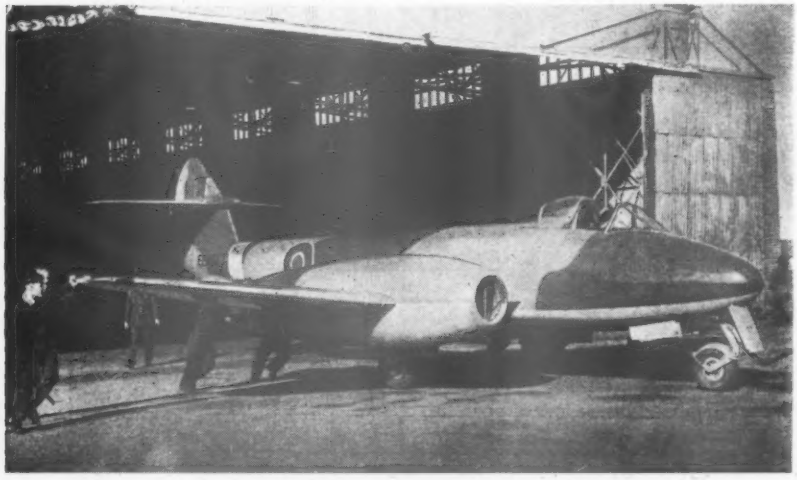
On the other hand there is force in the argument that if British lines require a subsidy from a taxpayer, then they ought to be under the tax-payer's (the government's) control.

Lord Winster did provide one ray of hope. He said that on January 1 private flying would again be allowed. But British manufacturers have few light aircraft in preparation.

Turbo-jets

Both the *Goblin* and the *Derwent* turbo-jets were at a recent Farnborough exhibition. The *Goblin II* gives a 3,000-pound thrust. It is fitted to the de Havilland *Vampire*. The *Derwent* can give a 4,000-pound thrust. The Rolls-Royce *Nene* is bigger than the *Derwent* and has been quoted at 5,000-pound static thrust.

(*Continued on page 114*)



Gloster Meteor IV leaves hangar to set new record of 606 m.p.h. The plane has a wing span of 43 feet, length of 41 feet, is powered by two Rolls-Royce Derwent turbo-jets.

AIR VICTORY
OVER JAPAN
Critics scoffed, but air power beat Japan.
Here is a 32-page official AAF report.

HOW AIR POWER BEAT JAPAN

This 32-page section concludes the series of three special reports, summarizing aviation's part in our victory, which FLYING *has given to its readers in recent issues. The material has been reprinted from the Army Air Forces' hitherto classified publication,* Impact. *The first two of the series summarized, respectively, the strategic and tactical phases of the air war in Europe. This is a report on both tactical and strategic phases of our Pacific air war against the Japanese Empire.*

THE Japs had something which we didn't have. They had a scheme. It was a grandiose scheme that befitted true Sons of Heaven. We came to know of it as "The Greater East Asia Co-prosperity Sphere." The name was illusory because it entailed a great deal more than Asia and had nothing whatever to do with co-prosperity.

It had been in the back of the Japanese mind just about as long as the Japanese had been trying to become a modern nation—ever since Commodore Perry reawoke them to the fact that there was a world going on.

For two hundred years prior to that time, the Japanese had been living a proud, feudal, insulated existence—and had liked it—or at least the ruling Japanese liked it, which is all that has ever mattered in Japan. Commodore Perry did not convince them that they were backward and ridiculous. On the contrary, he merely convinced them that if they were going to maintain their separate existence, they would have to incorporate modern methods and expand the area of insulation. That, in brief, is the Greater East Asia Co-prosperity Sphere—a great realm where Japanese ideas and ideals would be immune from the Occidental influences, large enough to provide all the necessities and luxuries of life, and long enough and wide enough and powerful enough to be impenetrable.

The Japanese scheme failed.

The Japs failed, first of all, because Germany failed. Japan predicated the assumption of victory on a German victory and planned her grand strategy on that assumption. History will show that Stalingrad was a catastrophe—for Japan no less than for Germany.

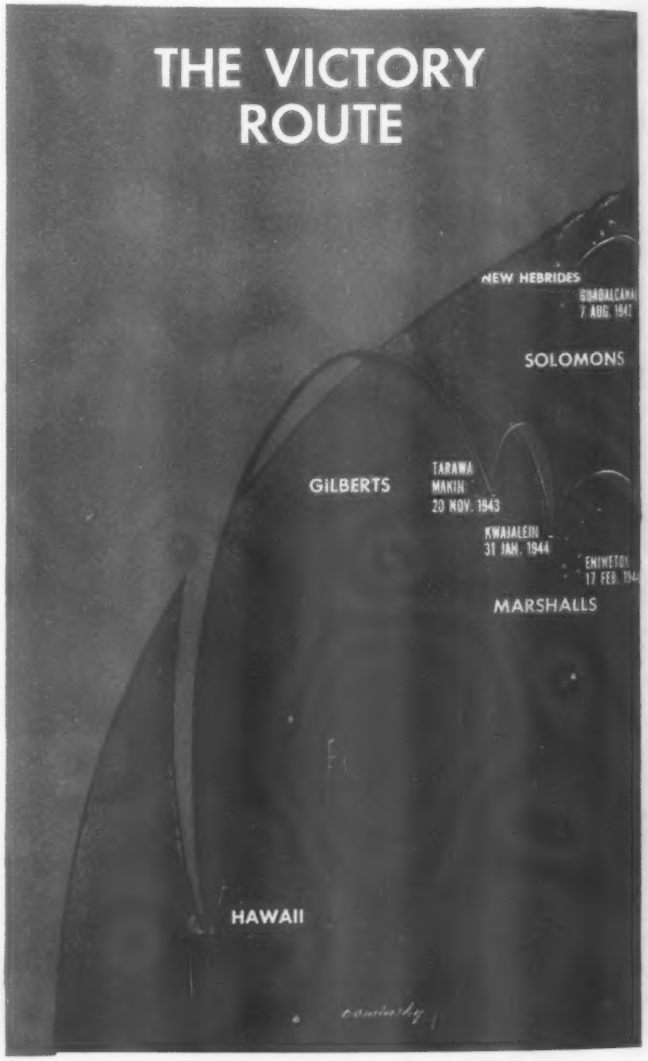
The Japs failed, secondly, because they could not keep pace with Allied production. They started the war with numerical superiority in practically every field of army and navy equipment and vastly increased that superiority in the opening months of the war by attrition against the Allies. Thereafter, the scales turned quickly against them. When the U. S. finally brought strategic bombers to bear on the Home Islands, so that production and attrition would work hand in hand, the Japs didn't have a chance. They were faced with Allied superiority in planes, ships, and all the impedimenta of war which rapidly snowballed to stupefying proportions.

The Japanese failed, thirdly, because they did not possess a scientific "know how" to compete qualitatively. Jap equipment rapidly became inferior to ours. At the end of the war they did not have one single operational weapon which was superior to ours or which we could not have produced. In the critical new weapon developments of this war, Japan was practically at a standstill while the Allies were racing ahead. Japanese radar was crude by our standards. She had nothing that even approximated a *Flying Fortress* or a *Liberator*—let alone a *Superfortress*. And she was constantly perplexed, bewildered, and confounded by a galaxy of Allied weapons—air-to-ground rockets, napalm, computing sights, proximity fuses, aerial mines, bazookas, flame throwers, the atom bomb. It was these things, and the Japanese inability to produce them, which the Nip post mortem artists are blaming for their defeat.

The Japanese failed because their high command failed. Japanese strategy was based on the assumption that the United States could be surprised and beaten before we could arm ourselves and fight back effectively. They made the mistake of believing their own propaganda—that there was internal dissension in the United States, that Americans were peace loving and decadent, and that it would take them years to switch from luxury production to war output.

Japanese strategists and technicians fought their war straight out of the rule books. The rule books were never revised until the Japs learned, through ugly experience, that they were obsolete, and when the Allies got out editions of their own or fought off the cuff, the Japs were dumbfounded and incapable of effective countermeasures. A case in point was the Jap belief that "unsinkable aircraft carriers" would afford impregnable barriers to our advance across the Pacific. When it was proven that superior carrier air power could knock out island bases, and land-based planes could keep them neutralized, the Japs had no alternative defense.

Japanese strategists apparently could not foresee a situation in which they did not have the initiative. Their conception of war was built around the word "attack." When they were put on the defensive, it took them a long time to learn that there were better stratagems than an heroic *banzai* charge and, when the trend was against them, they sometimes lost their capacity

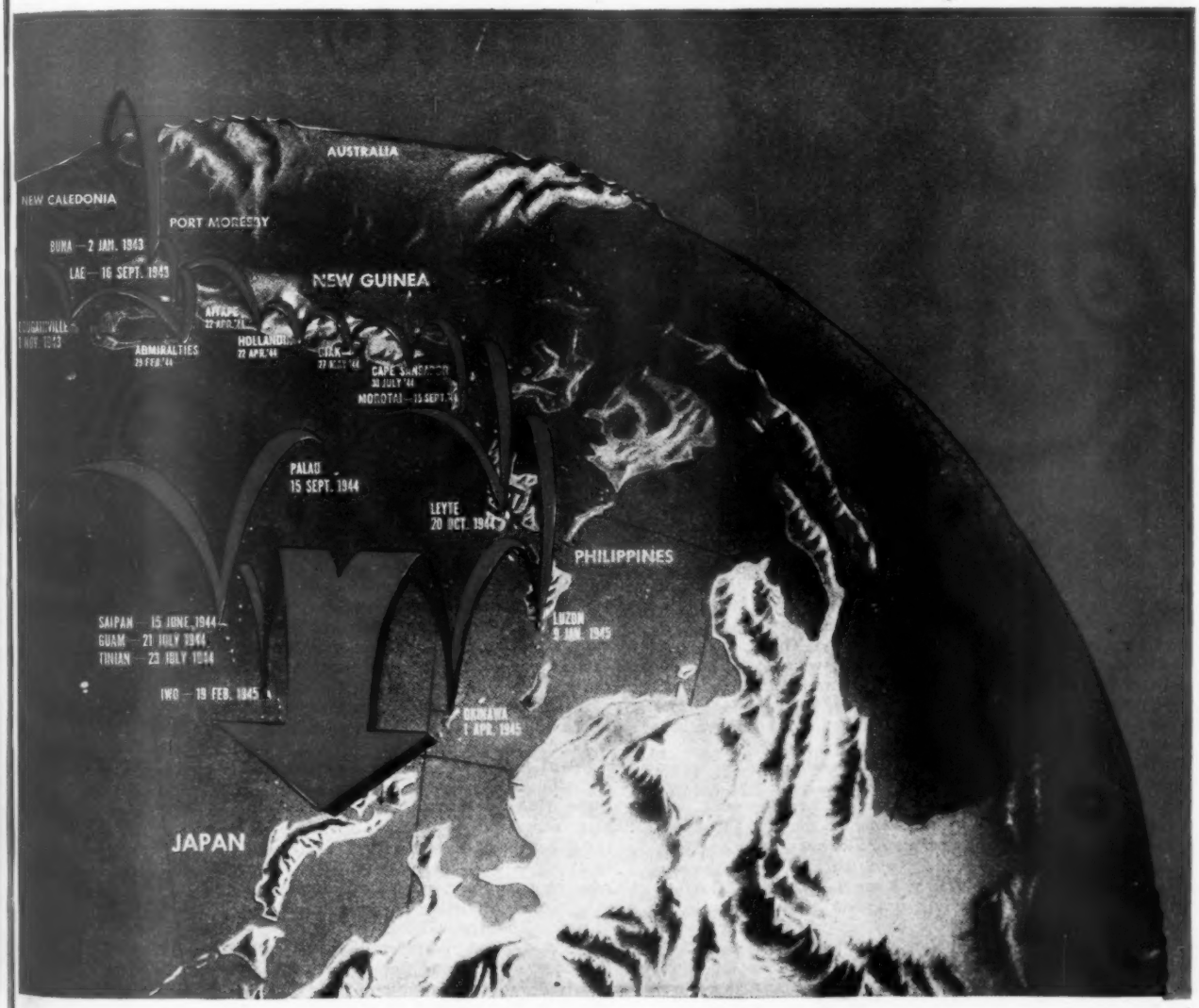


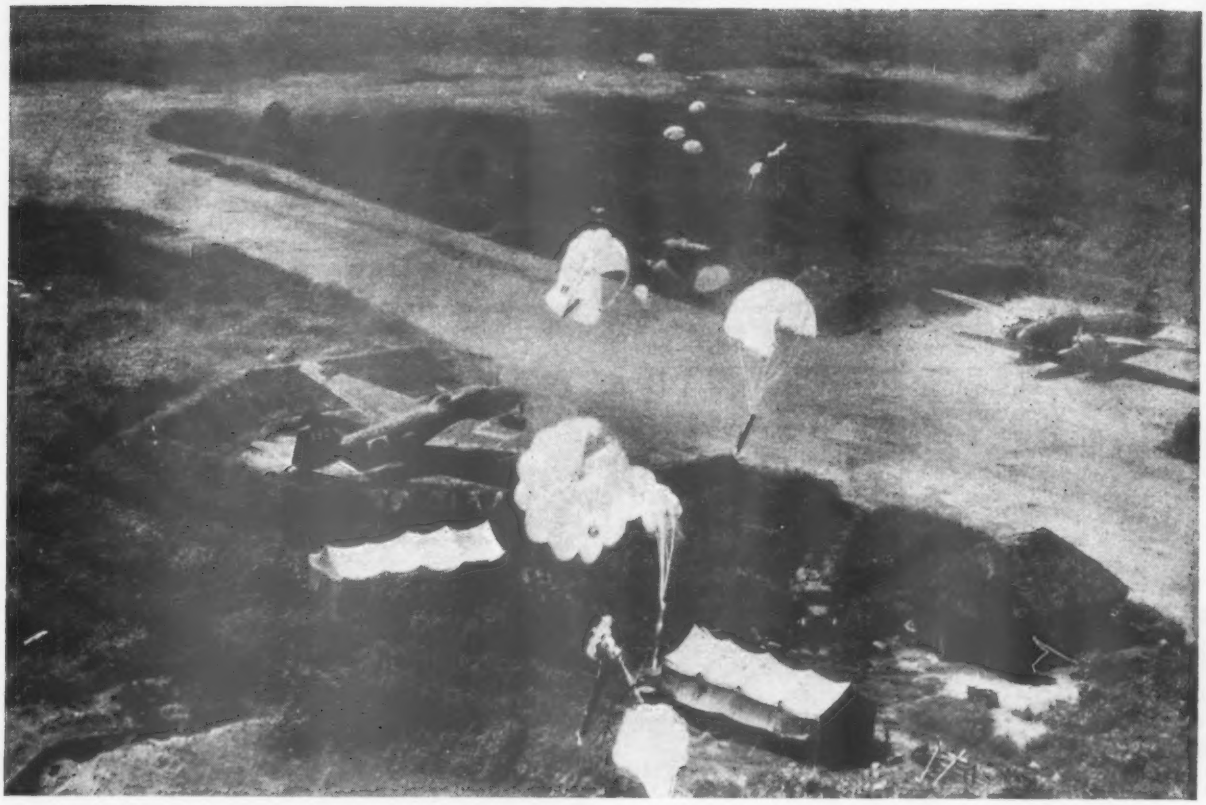
Air power needed land power and sea power to secure the bases. After that, its blows destroyed Japan's war-making potential.

for straight thinking and blundered themselves into a mess. Witness the Marianas incident, when the cream of the naval air force was caught outside its radius of action, or the Yamato engagement, when the pride of the Jap fleet, in a futile move toward Okinawa, was sunk by carrier planes. Or the first weeks on Guadalcanal, when the Japs couldn't utilize an overwhelming air superiority efficiently enough to wipe out Henderson field.

The Japanese strategists did not understand, until too late, the potentialities of air war. Like the Germans they thought of air power in terms of an attack weapon to be used as support for naval forces and ground armies. Because they themselves had no formula for the use of strategic air power, they overlooked the possibility that it would be used against them and so were unprepared to counter it. The JAF was built around a force of short range bombers and fighters that were flimsily built, armorless, fire traps. The bombers were incapable of sustaining an offensive that really packed a wallop. The fighters were increasingly ineffective against Allied bombers that were forever flying places and doing things that the Japs hadn't anticipated soon enough. The Japs learned about big time air war but they learned it the rough way—just as guinea pigs learn about shock treatment from scientists.

The Japanese failed, last of all, because their men and officers were inferior—not in courage—but in the intelligent use of courage. Japanese education, Japanese ancestor worship, and the Japanese caste system told off time after time in uninspired leadership and transfixed initiative. In a predicted situation that could be handled in an orthodox manner, Japanese soldiers were always competent and sometimes resourceful. Under the shadows of frustration, however, the obsession of personal honor extinguished the spark of ingenuity; and a deteriorating situation would provoke an increasingly irrational resistance. The Japanese air force's attempt to break up the Leyte landing is a case in point. For days the Japs tried conventional bombing tactics and were shot down by the hundreds without doing appreciable damage. Failing in this, the only improvisation they could conjure up was suicide attack. Contrast this desperate failure with Allied success in the Battle of the Bismarck sea, when less than 150 miscellaneous 5th Air Force planes co-ordinated tactics and techniques to skip-bomb, machine gun, and precision drop an entire





Important objective in the drive up the islands toward Japan was to neutralize the big Jap base at Rabaul. Here the Rabaul airfield is under parabomb attack. Rabaul was under such constant fire that it did not have to be captured by our ground forces.

convoy to the bottom within range of a numerically superior Jap air force.

All of these failures add up to one thing. The execution of Japanese plans was not equal to the grandiose demands of their strategy. They found out that the exquisite ambitions of the Sons of Heaven could not overcome the limitations of the common, mortal Jap.

But sometimes we were lucky. We must admit that. We were lucky, those first few months, to be fighting an enemy who was mentally incapable of exploiting his advantage. We were lucky the Japs didn't throw everything at Oahu. And we were lucky at Port Moresby when General MacArthur played them for suckers with a superb bluff on a bust hand. After that, the deal shifted and all the luck in the cards couldn't help the Japs to escape the show-down.

By the time the American offensive got started at Guadalcanal on August 7, 1942, the Japs had gone a long way toward reaching their goal of strategic isolation. The Allies were pushed back to India, to Australia, to Hawaii, to Alaska—to bases so far distant that only an occasional submarine could scratch feebly at the jugular vein, and only Lieutenant Colonel Doolittle's monumental gesture of defiance could cause a momentary tremor of the heart itself.

Although the Japanese empire was vast and her armed forces formidable, she was vulnerable. Japan had delicate arteries and a bad heart. The value of her captured land masses and the armed forces that defended them was in direct proportion to the ability of her shipping to keep them supplied, to keep the forces mobile, and to bring back to Japan the raw materials that make it possible to wage modern war. Destroy the shipping, and Japan for all practical purposes would be four islands without an empire—four islands on which were a few dozen made-to-burn cities in which were jam-packed the people and the industry that together made up the Japanese war machine. Destroy the shipping and burn the cities, and the whole empire complex would be like forsaken puppets —lifeless without strings and a master hand to play them.

These were the basic conceptions of American strategy—a war of attrition against Japanese shipping that would be waged on an ocean-wide front coincidentally with a gouging thrust straight towards the Home Islands—to positions where land-based bombers could sever the arteries and pound away at the heart.

The future course of the Allied offensive was determined at Guadalcanal. It seemed a long way to Tokyo. It was. It seemed like a pretty small beginning. It was. It seemed like a lot of men and time and effort going into the acquisition of a jungle mud hole.

It was worth it. The Japanese reaction to our landing was proof enough of its strategic value. But the Guadalcanal operation paid off in higher terms than real estate. We prospected a theory on Guadalcanal and brought in a gusher. The theory was that an Allied force, working with an airfield and some planes (a muddy jungle slash and obsolete fighters would do) could beat off the Japs and eventually push them back to decisive defeat. We did just that. Armed with confidence and the promise of increased capital in the form of more and better planes, ships, and equipment, and more men, the prospects of developing the whole field into a bonanza looked excellent. We could go ahead.

The technique of triphibious warfare was evolved and became so standardized in its pattern that it was almost a ritual. Submarines were usually the advance agents, snooping, harassing, diverting, and raising hell with enemy supply. Long range reconnaissance bombers might be the next on the scene or it might be a carrier task force that would come quickly, concentrate a Sunday punch on the enemy air force and shipping, and retire before the Japs could bring tactical superiority to bear. There would follow a few weeks, or perhaps months, when land-based planes would take over the job of interdicting the base, neutralizing the air facilities and knocking out the gun positions and strong points. In due time the landing force would arrive, escorted by a suitable task force which would do as much as artillery preparation and aerial bombardment

The Japs strike against our gathering forces in the south. Here one of our Liberators is burning at Funafuti after an attack at 4 a.m., April 22, 1943. But as we strangled Jap supply and our power increased, we kept them more and more on the defensive.

could do to smooth the way; and then the ground forces would establish a beachhead and push inland; and then the combat engineers, or the Seabees, or the construction battalions, or the air engineers, or perhaps all of them, would take over, with bulldozers and carbines; and then an airfield would be ready and planes would start to come in, artillery spotters first, then the fighters and night fighters, and then the bombers; and then the place would be declared secure, and the Japs would write off one asset and we would start to process another.

For a long time it was muddy going in low gear but in 1944 the Allied offensive started to roll. By that time we had definite superiority, quantitative and qualitative, in ships, planes, equipment, and technique. General MacArthur hedgehopped up the islands towards the Philippines. Kwajalein and then Eniwetok fell in short snappy campaigns. And Navy task forces, no longer tied down to direct support operations, flexed their muscles and paraded forth to cut the enemy in his vaunted strongholds and to slap his face with the established fact that from henceforth the U. S. would make a hobby of the Pearl Harbor game.

June 15, 1944, was the day that the American offensive reached level ground and switched to high gear. That was the day that China-based *Superfortresses* cast their shadows on Yawata and that was the day that forces stormed ashore on Saipan. It was the day that the Japanese high command had to admit, to themselves at least, that their beautiful dream of insulation had turned into an horrendous nightmare.

Having taken the Marianas, we were finally in a position, with the *Superfort*, to wage a strategic war of attrition against the Japanese empire. From here on in, the increase of Allied strength would go hand in hand with the deterioration of the Japanese capacity to fight back. We were ready to launch a vicious spiral of destruction from which there could not possibly be any escape. If the Japanese backed up farther, we would advance more quickly. If they chose to stand and fight, we would destroy them and have so much less to cope with later on. It was as simple as that. It was as simple as that because the Allies had amassed a power that was titanic. The Japanese could not stand up to it and there was no place they could go to get away from it. They had no immovable object to place against the irresistible force. Eventually they had just one final choice—give up or be destroyed.

The road to Tokyo started where it had to; started from where we picked ourselves up after being kicked out of the Philippines. out of the East Indies, out of all the places within reach of Japan.

It was a long trek, made over a bridge whose spans were pushed forward one by one and anchored to bases won by the combined strength of land, sea and air. This is the story of how we got to our starting point, and how the Army Air Forces helped to build and use the bridge.

On the first day of war we lost two-thirds of our aircraft in the Pacific. Hawaii was erased as a source of immediate reinforcements for the Philippines. And in the Philippines, where enemy attacks continued, our planes were whittled down rapidly. The kicking out phase was under way, with the 19th Bombardment Group taking its 14 *Fortresses* to Australia and then to Java for a brief but futile stand. The 24th Pursuit Group continued to give such aid as it could to the troops as they gradually gave ground in the Philippines, but its extinction was in sight before the end of 1941.

The air effort to hold the Netherlands East Indies radiated from a main air base at Malang, Java. Japan's 10-to-1 numerical air superiority and the swift onrush of its invading troops soon forced abandonment of all hope. In late February, 1942, evacuation was ordered and by early March the planes of the 5th Air Force, around which Southwest Pacific air strength was to be built, were in Australia.

Fearful anxiety gripped Australia. The Japanese sweeping in through the East Indies had brought Port Darwin and other western cities under air attack. While battering the 5th Air Force, they launched another prong of their offensive with air attacks on northern New Guinea, the Admiralty Islands, New Ireland, New Britain and the Solomons. Australia was being

sealed off from the north. Late January landings at Kavieng, Rabaul and Bougainville made it clear that Australia's supply line from the United States was threatened. The same landings would protect the enemy's left flank and serve as springboards for invasion of the island continent.

The 5th Air Force had arrived in Australia from Java with virtually no fighters and few bombers. It was a negligible factor until replacements could arrive. Australia itself was similarly weak. Outpost garrisons in its island possessions to the north were over-run and it had only 43 operational combat planes. The gravity of the situation was apparent and reconnaissance planes' reports of massed enemy shipping at Rabaul increased the tension. Just to the north of Australia, in southern New Guinea, was Port Moresby. Its loss to the enemy would eliminate Townsville and other northeastern Australian cities as plane bases, would shove our planes back from within reaching distance of Rabaul. When in early March a Jap convoy sent troops ashore at Lae and Salamaua in northern New Guinea, the noose was beginning to settle. Planes from two U. S. carriers opposed the Lae-Salamaua landing, sinking 15 vessels after spanning the mountains from the gulf of Papua, but the landing went on.

Coral Sea and Midway

The victory-flushed enemy, annoyed but not seriously worried by the Doolittle Tokyo raid of April 18, then pushed a convoy into the Coral Sea, aiming it at Port Morseby. Two carriers, seven cruisers, 17 destroyers, 16 unidentified warships, 21 transports and two submarines were spotted by a reconnaissance plane on May 4. U. S. fleet units, concentrated in Australian waters, challenged it. Land-based planes struck at enemy airfields at Lae and Rabaul to neutralize them, while carrier planes attacked the convoy. It was an air engagement. Neither fleet's surface units got within gun range of the other. By May 9 the battle was over, the convoy routed by the carriers. The Japs had suffered their first major defeat of the war and Port Moresby had a new lease on life.

Then came the events which slowed the tempo of Jap expansion and stabilized the outer perimeter of the enemy's conquests in the Pacific. On June 3, Jap warships were sighted west of Midway. *Fortresses* of the 7th Air Force reached out to them for initial attacks while our carriers under forced draft got within fighter range. As in the Battle of the Coral Sea there was no contact between surface forces and also, as in the earlier engagement, the Japs suffered a crushing defeat. Four carriers, two cruisers, three destroyers and a transport were sunk, others were damaged and 275 of the enemy's planes hit the water. We lost a carrier, a destroyer, 150 carrier planes, two *Forts* and two *Marauders*. Our Navy's carrier arm had established its superiority over the Japs; had depleted the enemy's carrier forces so sharply that never again could Japan strike as swiftly, in as great strength, over as vast an area as she had before.

While the Midway force was steaming toward disaster, another group of vessels was playing hide and seek in the Aleutian fog. It lost a lone plane over our then secret base at Umnak on June 3 and launched its attack on Dutch Harbor the next day. It was met by fighters from Cold Bay and Umnak, and our bombers sought the carrier force. A few contacts were reported and a carrier was damaged, but the weather was so bad that vessels could be held in sight for only a few minutes at a time. The Japanese withdrew under cover of the fog and a week later reconnaissance showed them in possession of Kiska and Attu.

The Early Days in New Guinea

The Midway reverse slowed the enemy, broke the previously unrelieved gloom in which the Allies moved, but did not eliminate the tension in Australia or the threat to Port Moresby. Moresby was under unremitting air attack; was too hot for heavy bombers which moved to it from Townsville, refueled, hit Rabaul, and scampered back to Australia. But Moresby was an essential in the MacArthur promise to return to the Philippines. Gen. George C. Kenney, who took command of the 5th Air Force, gave assurance that with the few planes he had, plus expected reinforcements, he could get and hold air superiority. And so, despite continuing air attacks and the ever-present possibility of assault from the sea, Moresby was developed through the spring and summer of 1942, with seven landing strips taking shape. It was the base we had to have to trade blows with the enemy; the base from which we could reach Rabaul.

Moresby could be held only if Kenney's planes could meet the Jap air attacks and beat them down, exacting a heavy toll while husbanding their own numbers. They had to do it with far too few planes which had to fly too many hours in every week. They had to do it with planes which could not match the Zero in maneuverability, in speed of climb or speed in level flight. But they had some tools the Japs lacked. They had the *Fortress*, a weapon which could outreach anything the enemy had, striking from bases relatively immune to attack. They had fighter planes which were built for defense as well as offense and would not become flaming torches at the flick of the enemy's trigger. They had men, too, with ingenuity in maintenance, flying and tactics. These were the things which kept the 5th Air Force in Moresby through the spring and summer of 1942.

Then in late July the Japs landed at Buna, Gona and Sananda on the northeast coast of New Guinea, just over the Owen Stanley mountains from Moresby. They started to push up the Kokoda trail while Australians fought a delaying action in retreat. Kokoda fell, the Japs pressed on through the mountain pass—and then Port Moresby began to pay off. Troops staged there moved out to meet the enemy in the mountain jungles. The 5th's planes got their first taste of co-operation with ground troops under conditions of tremendous difficulty. As they strafed and bombed Japs along the trail and hit at supply dumps, they rarely saw their targets, concealed in the jungles. Vague reference points in a confusing welter of trees and valleys and ridges were all they had. But they struck at them and at airfields and at coastal shipping. They flew as long as the planes would hold together, then tied them up with stray bits of wire and flew some more. They improvised: old P-400s (modified *Airacobras*) were turned into dive bombers with a 500-pound bomb slung underneath. And then as the Australians stopped giving ground and halted the Japs just 30 miles from Port Morseby, the 5th Air Force played its biggest role in the campaign, sparking the start of MacArthur's since-famed hop, skip and jump warfare.

With Gona-Buna in enemy hands, Port Moresby would never be secure, Rabaul could not be neutralized and an advance out of the Southwest Pacific could not get started. The Papuan campaign was initiated with the ground push back across the Kokoda trail and an airborne leap of 15,000 men across the mountains to near Buna. The Troop Carrier Command ferried engineers with equipment to hack out airstrips, then moved in the troops and their equipment. The lack of aircraft was as acute for transport as it was for combat, and bombers were pressed into service and loaded with artillery. The ground forces were dependent on air supply for food, ammunition and equipment The air supply route was maintained with its terminus almost in sight of the Japs. Casualties were evacuated on the return flights. Buna was overrun on January 2, 1943, and the threat of Port Moresby was ended. The first span was in place.

Meanwhile in the late summer of 1942 the Solomons campaign was started. Its immediate objective also was the security of Australia. The Jap invasion of the Solomons had pressed the sharp cutting edge of the expansion knife close to the Australian supply artery. The entire push back to the Philippines depended on building Australia into a tremendous storehouse of men and material, and it was endangered to a critical degree when Guadalcanal was occupied by the Japanese. Guadalcanal had to be retaken.

Solomons Campaign

AAF planes, later to be formed into the 13th Air Force, launched attacks from Espiritu Santo on Jap positions on Guadalcanal and Tulagi while 5th Air Force planes struck at Rabaul. Navy and Marine flyers ranged up and down the Solomons, striking at shipping and at airfields, preparing for the day of invasion. On August 7, 1942, the Marines went ashore on Guadalcanal. For three critical months they battled the Japs on little better than even terms. Allied strength was barely adequate and the enemy kept pouring reinforcements down from Rabaul. But incessant naval and aerial patrol and attacks on shipping gradually cut into the Japs' ability to bolster their failing troops and turned the tide of battle.

By late October we had aerial superiority and by mid-November heavy bombers were flying from Guadalcanal's Henderson field. The battle was won and mopping up completed in February, 1943. Guadalcanal was the first step toward Rabaul and it was followed by invasion of the New Georgia islands in the Central Solomons at the end of June and by invasion of Bougainville November 1, 1943. These steps put Rabaul within easy fighter range of the 13th Air Force. Its harbor and airfields could be kept under daily attack. But Bougainville was not taken easily. Ground fighting was bitter and costly. The enemy struck with his full air power again and again, but as in New Guinea, the U. S. flyers were the masters. They had met overwhelming numbers and by out-flying and out-thinking the enemy had racked up ratios of 10, 20 and even 30 to 1 destroyed. By late 1943 pyramiding enemy losses coupled with mounting U. S. production made it clear that destruction of the Jap air force was only a matter of time.

While Guadalcanal and Port Moresby were being made secure and the first advances made beyond them in the Southwest Pacific, other events had been giving notice of growing Allied strength. In the Aleutians, Kiska was by-passed and a landing made on Attu in May, 1943. This former American island had been bombed occasionally from Adak and Amchitka, but persistent low-hanging clouds made it less profitable for attack than Kiska. The Attu landing, then, was a surprise maneuver, going past the island most heavily attacked and most heavily defended. Attu fell on June 2 and American forces stood between Kiska and its supply base in the northern Kuriles. On August 15, Canadian and American troops stormed ashore on Kiska and learned that the by-passing technique was effective. There were no Japs on the island. They had pulled out in late July under cover of a weather front so thick that one of the evacuating destroyers saw Little Kiska Island dead ahead, thought it was an American warship, and opened fire. Not only had American soil been freed of the invader by the Aleutian campaign; we had moved into position for the 11th Air Force to begin its strikes against the Kurile Islands. These attacks, which increased steadily as radio navigation aids and radar lessened the need for good weather, forced the Japs to consider the possibility of an attack from the north, forced them to tie up more men and planes and ships than they could afford when their southern flank was crumbling.

In the Central Pacific, too, things were beginning to jell. Wake Island had been hit occasionally by the 7th Air Force in flights staging from Midway, but since the 7th was sending most of its planes into the Solomons action under the 13th Air Force, it had little offensive power. In April, 1943, however, phosphate-rich Nauru and Tarawa in the Gilberts were blasted. These islands continued to be occasional targets and in September Army and Navy planes joined to give Tarawa a thorough pasting. The explosive force with which the United States rocketed across the Pacific in 1944 was beginning to gather.

Campaigns for New Guinea and the Marshalls

New Guinea's re-conquest, to spring from Australia by way of Buna and Gona, required two things above all: denial of reinforcements to the Japs, and protection of Allied troops from aerial attack. The 5th Air Force accepted major responsibility for both. The first obligation was spectacularly fulfilled in the Battle of the Bismarck Sea.

Kenney's ubiquitous bombers had been roaming the coastlines and ranging out to sea with increasing frequency as the 5th began to gather strength. On the first of March, 1943, a reconnaissance *Liberator* spotted a large convoy with destroyer escort steaming west off the northern coast of New Britain. It carried supplies and more than 12,000 men for reinforcement of Lae. When word of this juicy plum was flashed back to base, a flight of *Fortresses* was dispatched. The convoy, however, was hidden in a front and contact was not made. At dawn the next day, the 5th mustered all its planes, sending *Havocs* to immobilize the airfield at Lae, *Liberators* and *Fortresses* with *Lightning* escort to the attack. The convoy was sighted and bombed from medium altitude. Four ships were sunk. Later in the day a flight of *Forts* attacked again as the ships maneuvered under a cover of squalls. That night the weather changed and by morning the convoy was entering Huon Gulf under clear skies. That was the jackpot day.

Tests by the Proving Ground Command at Eglin Field, Fla.,

Kwajalein, in the northern Marshalls, was invaded in a brilliant maneuver which caught the Japs expecting us in the south. Only two months later, this picture shows our massed aircraft ready for the next advance across the central Pacific—to the Marianas.

We are moving faster now. Corregidor, scene of Jap triumph and American defeat, is bombed.

Paratroops land on Corregidor. The Japs had their guns pointed at the sea but we came by air. After heavy aerial and sea bombardment, the paratroops landed topside and rooted the enemy out.

had established the feasibility of masthead bombing—a low-level broadside attack with the bomb plunking squarely into the side of the vessel. Synchronized high-level attack and accompanying fighters were recommended. Quick to seize on new ideas, the 5th's *Forts* successfully used low-level attacks on ships in Rabaul harbor at night. Its *Mitchells* and *Havocs* practiced the technique on an old hulk at Port Moresby between combat missions. The *Mitchells* gained added security and lethal power by a modification which gave them eight forward-firing .50-calibers through a modification made in the theater.

Thus on March 3, 1943, the unsuspecting Jap convoy was keeping a date with eternity. As it entered Huon Gulf, *Beaufighters* went in first, taking the screening destroyers as their strafing targets. With AA fire lessened and scattered, the heavies picked their targets from medium altitude and made repeated bomb runs. The *Mitchells* and *Havocs* then sprang the big surprise, raking the decks as they approached and dropped their bombs just before they pulled up and over the masts. All the while, *Lightnings* were overhead engaging the convoy's fighter cover. The convoy was dead as darkness fell. The next day attacks on the Lae airfield continued as planes searched for survivors. The final mop-up was on March 5 when *Beaufighters* and *Mitchells* put an end to the rafts and lifeboats. Land-based airpower had demonstrated that when properly employed it could stop an invader before port could be reached. From that time on the Japs were forced to spirit their troops along the coast of New Guinea at night in camouflaged barges which hugged the shore and darted for cover at the approach of dawn. The commitment of the 5th to prevent reinforcement of New Guinea had been met.

The second of its tasks, protecting troops from air attack, involved destruction of the Jap air force in such numbers that eventually replacement would be foolhardy. That commitment was met too. It was met by better flying in aerial combat, through surprise attacks on airfields which destroyed the grounded planes, and by construction of airfields.

The next jump of MacArthur's forces from Buna was to Lae. Not only was it in the right direction for the move toward the Philippines but its possession would be a powerful factor in the neutralization of Rabaul. In aid of the Lae offensive, aviation engineers made a long overland trek to 40 miles southwest of the coming battlefield and cleared a site for Marilinan field. As soon as transports could land, *Skytrains* moved in an airborne engineer battalion with all its equipment plus antiaircraft guns. This field was expanded and soon became the major base from which Wewak was put under attack. Four Jap airfields were in the Wewak area and all of them nested scores of planes. The big show at Wewak preliminary to the intensive phase of the Lae campaign opened on August 17, 1943. At dawn the heavy bombers unleashed frag clusters, demolition and incendiary bombs. They were followed by *Mitchells* and *Lightnings* which scampered across the airfields disgorging parafrags, their machine guns chattering. The performance was repeated the next day. Then came a day of rest, followed by two more days of the same attack pattern. The result was 228 enemy planes destroyed on the ground and 81 shot out of the air against our loss of 10 planes. Wewak was out of business as a major base.

A few days later a landing east of Lae was effected, followed by the first extensive use of paratroops in the Pacific. To put a sizable force behind the Jap lines at Lae it was decided to capture the Markham valley site of Nadzab. Detailed preparation was made and the jump was a model of excellence. While General MacArthur and General Kenney cruised about overhead, *Mitchells* put the Nips under cover with a strafing and parafag attack. They were followed by *Havocs* laying a smoke screen, behind which 96 *Skytrains* shucked out 1,700 American paratroopers. Nazdab was ours and a week and a half later Lae fell. As infantrymen crossed the airfield, they found it a junkyard of shattered planes, souvenirs of the 5th's visits.

The entire Huon Gulf area was cleared out a few days later with capture of Finschafen. It reduced the importance of Rabaul and established a protected flank for future leaps to the west along the New Guinea coast.

In the late fall of 1943, this was the picture throughout the Pacific: in the north, the Japs had been driven out of the Aleutians, back to the Kuriles; in the Central Pacific, the Jap-held islands were taking occasional attacks; in the Southwest Pacific, the key base of Rabaul, one holding the dual threats of slashing the supply route to Australia as well as invading it, was itself threatened with isolation.

Rabaul still had air strength but it was maintained at terrific cost as our planes blasted it with rising tempo. Its harbor began to lose importance as the points to which it shipped men and supplies began to fall into Allied hands.

Tarawa and Makin were invaded on November 20, 1943. The Marines went ashore after seven days of intensive aerial softening. The Marshall Islands to the north were immobilized by concurrent attacks. The invasion spelled the end of reinforcements in strength for Rabaul but, more than that, it set the first pier for our bridge across the Central Pacific.

The pattern of Pacific advance was one of taking the bases we needed and by-passing the others. Those by-passed were not forgotten, however. They were hit again and again and again. And after they had lost all possibility of usefulness to the enemy, they were made practice targets for new crews; targets which still could put up some AA fire to season the crews at minimum risk. To the end of the war, Rabaul was getting a daily pounding although as a factor in impeding the push to Tokyo it had faded completely after the Tarawa landing doomed its reinforcements and subsequent landings at Arawe and Cape Gloucester threatened it from the west.

Truk now became the important base, with Palau likewise looming larger in the Japanese scheme of reinforcement of forward areas But those forward areas were soon to be lost. American task forces ranged through the eastern perimeter islands striking Mili, Jaluit, Kwajalein, Wotje and Nauru, churning their runways into coral rubble, burning their supplies. The same islands and others nearby were hit in daily

sorties by *Liberators*. By mid-December, fighters and bombers were taking off from newly won Makin to strike the Marshalls. Kwajalein was invaded in a brilliant maneuver which caught the Japs by surprise as we went through to the northern part of the Marshalls, skipping the more obvious southern invasion points. Throughout February, airfields in the Marshalls were bombed into uselessness and our planes ranged westward to immobilize the staging areas. Forty-two *Liberators* plastered Ponape in the Carolines on February 14, and two days later a Naval task force gave the great naval and air center of Truk a thorough shellacking, shooting down 127 aircraft and destroying 74 on the ground while losing only 17 of its own planes. It was an action timed to keep the Japs off balance while we invaded Eniwetok, where troops went ashore on February 17. All of the Marshalls and Gilberts were under constant fighter and bomber attack from that time, and as we gradually moved in and captured the key islands, air pressure by the enemy was kept at low level by destruction of planes and airfields both in those islands and in the Carolines to the west. Four major Jap islands were left to bake in the Pacific sun under an umbrella of smoke raised by almost daily neutralizing attacks. Mili, Jaluit, Maloelap and Wotje remained to the end as practice targets, symbols of the fate of the by-passed.

While the Gilberts and Marshalls were being taken in hand by the Navy, the ground forces and the 7th Air Force, the 13th Air Force made a jump to the Admiralty Islands north of our Huon Gulf holdings on New Guinea. That made it a partner of the 7th in blows on the Carolines, with special attention being given to Truk.

These blows along the Central Pacific route to Japan were falling while General MacArthur moved his forces westward along the north New Guinea coast. Infantrymen slugged their way through inland valleys parallel to the coast, and as they pressed the Japs back, amphibious operations put other troops behind the Japs to effect a pincers. The 5th Air Force continued its systematic destruction of the Japanese air force in New Guinea while blasting supplies, defensive installations and troops. In the last week of February, 1944, 900 sorties were flown and 1,000 tons of bombs dropped on the Wewak, Madang, Alexishafen and Hansa Bay areas, leading to the March 5 landing west of Saidor behind the Jap lines. Hollandia was the major enemy base after Wewak was shattered, with the Schouten islands and the Halmaheras backing it up as rear bases. But Hollandia was soon to share the fate of what in 1944 was the sorry lot of all Jap forward bases. On March 30, *Liberators*, *Lightnings* and *Thunderbolts* hit it. The next day *Liberators* and *Lightnings* gave it a final polish. The box score: Japan, 219 planes destroyed or damaged; the U. S., one P-38 lost. Three days later a force of 303 *Libs*, *Mitchells*, *Havocs* and *Lightnings* pulverized the area and shot 26 planes out of the sky. Hollandia was finished as an enemy bastion and on April 22 a long jump was made to it by invasion forces. The same day a precautionary firewall was built between it and the by-passed areas by a landing at Aitape. Then in turn came Wakde island on May 17, Biak island on May 27, Noemfoor on July 2 and Cape Sansapor on July 30. Western New Guinea was under control. The route now lay north through the Halmaheras to the Philippines.

Thrust to the Marianas

With MacArthur poised on the western end of New Guinea at the close of July, the Central Pacific forces under Admiral Nimitz's command had swept into the Marianas and likewise were set to move north or west. They reached the Marianas in one tremendous thrust from the Marshalls, past the Carolines, into Saipan on June 15. This was accomplished on the familiar pattern of neutralization of all surrounding bases. Daily strikes were made on Truk, Ponape, Woleai, and Yap. The Peleliu airfield in the Palaus was the target of five attacks in three days. While the 7th and 13th air forces were neutralizing the Carolines, carrier planes attacked Saipan, Tinian, Rota and Guam in the immediate invasion area. The fleet started shelling Saipan and Tinian two days before the landing. On D-Day, carrier planes made sustained attacks on the enemy bases on Iwo, Haha and Chichi islands. These attacks on bases from which the invasion could be hampered were accompanied by a diversion in the north. The Navy shelled Matsuwa Island while 11th Air Force and Fleet Air Wing 4 planes bombed Paramushiru and Shimushu in the northern Kuriles. As the battle for Saipan progressed, carrier planes continued to sweep Guam, Rota, Pagan and Iwo while the AAF concentrated on Truk, Woleai, Yap and Ponape. The by-passed bases at Rabaul and in the Marshalls were attacked daily.

The threat in U. S. occupation of Saipan was obvious and the Jap fleet came out of hiding. It was discovered west of Guam and our carriers attacked on June 19. The ensuing Battle of the Philippine Sea was another in the series of naval engagements in which all of the contact was from the air and in which Japan's fleet was defeated. The enemy lost 428 planes, including those hit on the ground on Marianas bases in accompanying side action. Jap ship losses were 17 sunk or damaged. The U. S. fleet lost 122 aircraft and 72 men. During almost the entire action the American carrier planes were striking at about the limit of their radius of action and most of our losses were due to forced landings in the sea when the planes gave out of gas. The enemy's air reaction to the Saipan landing was strong but our air superiority was never in serious jeopardy. From the opening of the pre-invasion attacks on June 11 to a relatively stabilized condition on June 28, enemy plane losses in the Marianas and to the west in the Philippine sea totaled more than 750.

On D plus 5, an engineer aviation battalion began unloading equipment and on D plus 6 began repairing the runway at Aslito (renamed Isely) airfield. On D plus 7, 7th Air Force *Thunderbolts*, ferried from Hawaii by CVE, landed and took off on missions against enemy ground forces. The engineers widened and lengthened the runway, then turned to construction of a heavy bomber strip. They interrupted their work on the night of D plus 12 to wipe out 300 Japs who had broken through and overrun the airfield, but it was only a temporary halt. The Saipan operation was typical of the speed with which aviation engineers prepared new airfields: Isely field, started June 21, operational for fighters June 22, for *Liberators* August 9, for *Superfortresses* October 15. The engineers moved 4,500,000 cubic yards of coral and earth, produced 127,322 tons of asphaltic cement, paved 11,000,000 square feet of surface and consumed more than 1,250,000 gallons of diesel fuel in their round-the-clock performance.

After Saipan came Guam on July 21, followed by Tinian on July 23. Again both invasions were preceded by heavy air and naval bombardment, some of the help coming from the land-based planes on Saipan. The islands were "secured" by mid-August although isolated Japs were being picked off months later.

Planes of the Air Transport Command followed almost in the prop wash of combat planes as new bases were taken. Operations on the long overwater route steadily increased, with personnel flown from the United States to the Pacific theater in nine months of 1945 totaling 80,847 as against 75,560 in all of 1944. Similarly, in 1945, through September, tonnage flown was 39,518 and in 1944 it was 28,861. Evacuation of casualties to the U. S., a major factor in reducing the death rate from wounds, totaled 36,000 in 1945 and 10,498 in 1944.

Meanwhile, preparations went forward for the long-anticipated drive back into the Philippines. On September 15, the Palau Islands were invaded, the Marines heading into tough opposition on Peleliu, and Army ground forces having a somewhat easier time on Angaur. This placed the Central Philippines within range of our heavy bombers. MacArthur moved into Morotai, north of Halmahera, and the stage was set for all forces to unite in a single plan.

Back to the Philippines

In no previous Pacific operation did the preparatory phase cover such a vast area and involve so many different striking elements. The leading role was played by a tremendous carrier force of the Third Fleet, which struck along a vast arc from the Philippines to Marcus island, the Ryukyus and Formosa. In late September, they wrecked the Manila area, destroying 357 aircraft, and the next day pounded Leyte, Panay and Cebu. Then, in early October, they cut loose with a series of terrific wallops: Marcus Island on the 9th, the Ryukyus on the 10th, Formosa on the 12th and 13th, and Manila again on the 15th and 17th. Their score was 915 enemy planes destroyed, 128 ships sunk and 184 damaged. They lost no ships and only 94 of their own planes. This was essentially an operation to isolate the battlefield, to make it difficult for the enemy to reinforce the Philippines. Fitting into the same scheme

Here is the detail of aerial invasion. Our heavies blasted Kamiri airstrip on Noemfoor Island with 230 tons of bombs. Then paratroops landed to take over before the stunned Japs could organize for defense. This pattern improved with experience.

were three attacks on Formosa by China-based *Superfortresses*, constant attacks by the 5th and 13th air forces on the southern Philippines and East Indies flank, by the 7th on the Bonins, and by the 14th against harbors and shipping along China coast.

On October 20, troops poured ashore at Leyte.

Leyte was a dud from the beginning. As far as the air forces were concerned, it was mostly a case of mud. Torrential rains bogged us down everywhere. For the first time since we had struggled with the mud hole that became Henderson field, airfield construction was agonizingly slow, and it became apparent before long that our bomber strength could not be pulled into Leyte. Tacloban airstrip was the only strip that proved of real value. From it, the 5th Fighter Command, its planes jammed wingtip to wingtip, for weeks did an all-around air force job, handling many tasks that normally would have been given to the bombers. The latter, flying from Morotai, the Palaus, and bases on northwest New Guinea, were forced by distance to carry lighter loads. It had been expected that soon after invading Leyte they would be operating in force against northern Luzon.

Leyte was the closest we had come in a long time to losing a show. With the infantry and artillery slowly widening the beachhead perimeters and carrier aircraft the only umbrella over them, the Japanese navy appeared. It came in three separate thrusts, although one from the north never got into the Leyte action because it was met and routed by planes of the 3rd Fleet north of Luzon. The other two forces moved in from the west, threading their way through the islands toward Leyte Gulf, where the light and escort carriers of the 7th Fleet were protecting the invasion. Although spotted as they moved in and attacked by submarines, torpedo boats and planes, a strong Jap force reached Leyte gulf and on the morning of October 25 began shelling our carriers.

Despite the heavy ships the Japs had brought into the action through San Bernardino Strait, the battle swung in our favor and the enemy withdrew after suffering serious losses. In this action the Japs lost a golden opportunity, which was actually in their hands, to destroy our entire escort carrier and transport fleet in Leyte gulf. Our carriers, destroyers and destroyer escorts covered themselves with glory against tremendous odds. Meanwhile to the south the old battleships of the 7th Fleet, though short of ammunition, together with a fleet of PT boats, destroyers and cruisers, decisively defeated the enemy force which attempted to join the battle through Surigao strait. The Jap bid to halt the Leyte invasion had failed and their fleet had been reduced by sinkings and damage to task-force size. Our losses were the carrier *Princeton*, two escort carriers, two destroyers and one destroyer escort.

During all the operations in September and October, it was the carrier forces of the 3rd Fleet that dominated the air action and deserved the major share of credit. On the eve of the Battle for Leyte gulf, the Navy's vast Carrier Task Force 38

The Army Air Forces played a vital role in the China-Burma theater. Here a Lightning of the 14th Air Force drops a fire bomb (below tail) against the 1,100-foot wooden bridge at Wan Lai-kam, a main Jap escape route from Burma. Note pagoda, top center.

had a complement of 1,082 planes, and its Task Force 77, with the smaller carriers, could put some 600 planes into the air. The Far Eastern Air Forces (5th and 13th) had 1,457 planes assigned to tactical units and 524 held in ready reserve. The 7th, in the Marianas, Palaus and Marshalls, had another 526. While there were more land-based aircraft, the mobility of the carriers enabled the massing of great carrier striking strength at any required point. Truly, in these two months, carrier air, in a war dominated by sea masses rather than land masses, proved itself indispensable.

The end at Leyte came when the Japs discovered it was just as difficult as back at New Guinea to reinforce a besieged garrison. On November 10, a Jap convoy bound for Ormoc on Leyte's west coast was hit by *Mitchells* in a masthead attack which sank three transports and six escorts. The next day Navy planes smashed another Ormoc-bound convoy. On December 7, 5th Air Force fighter bombers sank all vessels in a 13-ship convoy, and four days later destroyed most of another, both near Ormoc.

Jap Air Debacle on Luzon

Throughout the Leyte campaign the Japs had dissipated their air strength in frequent, small attacks. Their opportunity was missed at the beginning when heavy, sustained pressure might have turned the tide. When we made an amphibious landing at Ormoc bay, followed on December 15 by a landing on Mindoro, the Japs struck hard. But this time it was too late. Once on the firm soil of Mindoro, the 5th Air Force was able to pull its main bomber strength up to the Philippines. The 5th now took up where the carriers had left off. In three weeks, the remainder of the Japanese air establishment in the Philippines was utterly demolished. On January 9, when MacArthur invaded the Lingayen Gulf, only two Japanese planes appeared over the beach. Never, in the European war or previously in the Pacific war, had such a crushing air defeat been administered. The 5th Air Force destroyed more than 2,000 enemy planes in the Philippines.

Yet the Japs had plenty more. Japanese aircraft production reached its highest level at this very time. They finally gave up sending more planes into the Philippines because the organization to operate them had been wiped out. The 5th Air Force not only made *every* decent airfield unserviceable, but also left *every* repair shop and storage depot a shambles. The entire ground maintenance system collapsed. When our forces reached Clark Field, they found a *George* fighter which needed only a carburetor to fly. Dozens of carburetors, as well as engines, wheels and hundreds of other parts, were found dispersed at nearby Mabalacat town in shacks, under buildings, and even buried in the fields. The *George* wasn't alone. Many planes were in almost flyable condition.

From this overwhelming defeat, the Japanese high command, however reluctantly, could draw only one conclusion: it would be senseless, in the future, to continue using their air force in the conventional manner. There was only one course left: a *Kamikaze*, or suicide, air force.

For the balance of the Philippines campaign, the 5th Air Force was free to roam at will against the shipping routes of the South China sea and to neutralize Formosa. This meant the 5th had taken over air commitments within range of the Philippines, freeing the carriers for two major tasks—Iwo and Okinawa.

Daylight attacks on Formosa started in January and soon *Liberators, Mitchells, Lightnings* and *Mustangs* were making regular strikes which at first were in preparation for and later in aid of the Okinawa campaign. The *Libs* also reached out across the China sea to disrupt communications in Indo-China. *Mitchells* were a potent striking force against shipping with their precision low-level attacks. In the Philippines, the 5th put on a whirlwind bombing and troop carrier show at Corregidor and, without air interference, swept against enemy troops wherever they still faced MacArthur. Outstanding were missions in aid of guerrillas, and napalm fire bomb attacks on Japs holed up in mountain caves.

The 13th Air Force, meanwhile, had been protecting the left rear flank as MacArthur turned north from New Guinea. It policed the Netherlands East Indies and southern Philippines, knocking out harbor installations, airfields, oil facilities and shipping. Borneo, Java, Celebes, Ambon, Ceram and lesser islands were scoured by planes of the 13th and the RAAF. Snoopers (single *Liberators*) picked off shipping in Makassar Strait. The oil center of Balikpapan was put out of action in four major strikes in which 5th Air Force heavies joined. The East Indies thus were eliminated as a staging area for Philippines reinforcement and were softened up for invasion.

Meanwhile, the Central Pacific forces forged their final arch in the bridge needed to put fighters over Japan. To the *Superfortresses* bombing Japan from the Marianas, Iwo had become increasingly annoying. To convert this warning station and interception point into a haven for distressed *Superfortresses* and a forward base for fighter sweeps over Japan, it was invaded on February 19. Hardly had the bloody struggle for Iwo ended when Okinawa was invaded. Coming so soon after

Iwo and at the very doorstep of the Home Islands, the invasion of Okinawa was a show of power that jolted the American public into the realization that the war against Japan might be approaching the final phases.

The Kamikaze Onslaught

This time the preparation included sustained strikes at Japan itself. The February blows in the Tokyo-Yokohama area prior to the Iwo landing were dwarfed by those which preceded the Okinawa invasion. The 5th Fleet on March 18 and 19 disposed of most of what remained of the Jap fleet and destroyed 475 enemy aircraft as its planes struck at airfields and anchorages in southern Honshu and Kyushu. From March 23 to 29 it made daily attacks on Okinawa and on southern Kyushu to disrupt reinforcements and supply. The 5th Air Force intensified its attacks on Formosa and was joined by British carriers in strikes on airfields and transportation facilities. Jap airfields on the east China coast were neutralized by the 14th.

Okinawa was invaded on April 1 and, after a few days of easy going, our ground forces ran into Japanese resistance that remained fanatical to the end. Japan's air force appeared in its new trappings and the Navy went through hell.

At Leyte, where the Japs first tried suicide tactics on more than an individual scale, they were a menace but not a critical one. Now, at Okinawa, the Japs came up with a predominantly suicide air force and the threat was critical in the extreme. The U. S. fleet and ships off Okinawa, were a made-to-order target for *Kamikaze* attack. The Japs did not repeat the piecemeal mistake of Leyte.

On April 6, date of the first intensive attack, the Navy was knocking down the *Kamikazes* without a moment's respite from dawn to dusk. Major assaults were made five times during the month and on the other days there were attacks at frequent intervals. The fleet's air patrol intercepted most of the *Kamikazes* but a large number inevitably got through to the outer screening ring of destroyers. A few pierced the defenses and reached the major fleet units. Proximity fuses, which detonated the ships' antiaircraft shells even though direct hits were not made on the enemy planes, increased the toll of suiciders but damage to surface craft continued to mount. In the 81 days of the Okinawa campaign 32 ships were sunk and 216 damaged by aircraft. Destroyers, destroyer escorts, minesweepers and smaller craft were the heaviest losers. Nine destroyers and one destroyer escort were sunk; 68 destroyers and 24 destroyer escorts damaged. Two ammunition ships were blown up in one attack. None of the major fleet units were sunk although many were severely damaged and lost for the campaign.

Long supply lines in Burma were vulnerable, but it was the Jap lines which were cut because our aviation dominated the skies.

The *Kamikazes* used both new and obsolete planes and introduced the *Baka*—a piloted bomb-with-wings—carried to the scene by a bomber and then released for its short and only flight. As the fleet stayed off Okinawa, shelling enemy positions and aiding the troops with carrier aircraft strikes, the menace of the suicide attacks grew. To lessen this, the airfields from which the *Kamikazes* flew were brought under sustained attack. Both the Amami group and the Sakishima group of islands, north and south of Okinawa respectively, were attacked daily by American and British carrier planes. Task Force 58, which had been giving its major attention to the Japs on Okinawa, with a side excursion on April 7 to sink the battleship *Yamato* and five other warships which apparently were moving out on a hit-run mission to Okinawa, initiated the sustained program to put *Kamikaze* bases out of commission. The carrier planes on April 15 strafed, bombed and rocketed airfields on Kyushu. The next day carrier planes, Marine Corps medium bombers and Army fighters from Iwo worked over the same area. Then on April 17 *Superfortresses* entered the picture. Five times in six days the *Superforts* dropped their heavy loads on Kyushu airfields, then, after a three-day lapse, closed out the month with five consecutive days of attack. Through the early part of May the *Superforts* continued these blows, striking seven times in the first 11 days. Carriers picked up where they left off and gave Kyushu a three-day dusting. By late May, *Thunderbolts* joined the attacks, flying from the small island of Ie Shima near Okinawa. These operations, combined with increasing success of our troops on Okinawa, gradually whittled down the scale of enemy attacks. In the first month of the invasion 1,700 Jap planes were involved in ordinary or suicide attacks; in May the total dropped to 700 and in June it was less than 300. Our ground successes were a greater factor in this reduction than the breaking up of Kyushu airfields, for, with the island definitely falling to us, the Japs withheld the bulk of their planes for a last-ditch defense of the Home Islands.

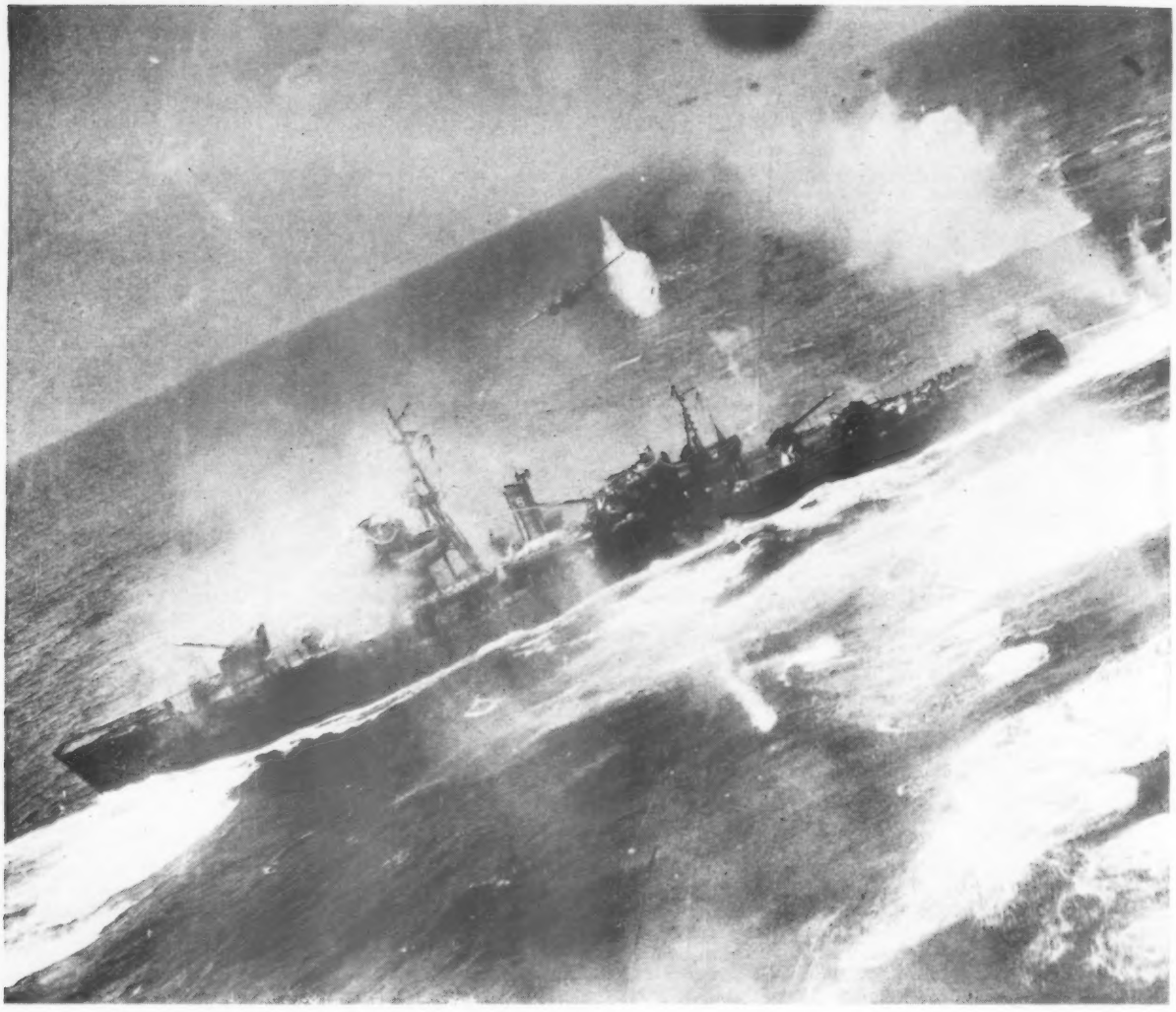
Long before Okinawa was wholly won, we began to carve out a network of bases which was to hold the invasion air force. As the Japs were compressed into the southern part of the island, fields began to blossom profusely over the central parts. As the bases took shape they began to fill with planes and daily strikes were made on Kyushu, paralyzing transportation, airfields, and cities. The final softening up for invasion in November was under way. Throughout July the tempo increased and by early August, despite unfavorable weather, between 350 and 450 sorties were being flown daily. This was scarcely a sample of what was in store, for from 23 bases on Ie and Okinawa, the re-deployed, B-29-equipped 8th Air Force was to join General Kenney's huge tactical air force in smoothing the invasion path. Even as the war ended the Navy was basing 625 planes on Okinawa, 32 *Superfortresses* had arrived and 1,317 planes of the tactical air force were ready to go.

It was an ironical twist of fate for Kenney, who had done so much with so little, particularly in the early days, finally to get a force of really great size just when it was no longer needed. For without a landing in Japan to put the final span of the Pacific bridge in place, the long trek ended.

The Air War in Burma and China

America's aerial effort in Asia was long an undernourished child, forced by circumstances to fend for itself; to improvise and, at first, to cling to its slender thread of life by whatever means it could. It developed into an unorthodox, vigorous air force. Its main achievements in Burma were in making it possible for Allied troops to exist in the jungle by supplying, evacuating and transporting them on an unprecedented scale and in making the Japanese position untenable, literally through starvation, by destruction of their supply bases which disappeared in a welter of bombed bridges, river boats, railroad trackage and freight junctions. In China it achieved command of the skies over Chinese troops, and tore gaping holes in the enemy supply routes on land and sea. Between India and China it flew the Hump in the greatest sustained transportation achievement of the war. And it did all this in weather which for more than half each year was so bad one pilot was moved to remark, "Flying, hell! This is an amphibious operation; we need gills more than wings."

The aerial infant from which this grew was born by 10th Air Force activation February 12, 1942. Before that, American



Japanese frigate is left afire and sinking by three 5th Air Force Mitchell bombers. Such attacks were added to the work of submarines and mines to strangle Japanese shipping and cut off supplies to Jap forward bases, many of which were completely isolated.

air power in Asia consisted exclusively of the American Volunteer Group. Claire L. Chennault, master tactician for China's air force, had obtained 100 obsolescent *Warhawks*, and 100 American pilots to man them, and some 200 ground personnel to keep them in the air. When this group of Flying Tigers met their first Jap over Rangoon on December 20, 1941, they were a single bright light in an otherwise dismal sky. China was isolated except for the Burma Road and Hong Kong, with the latter about to fall. Japanese forces were firmly entrenched in French Indo-China, had moved through Thailand, had swung one spearhead down the Malay Peninsula and another into South Burma. Rangoon fell on March 10, then came the "walk-out" of a motley array of British, Indian and Chinese troops led by Gen. Sir Harold Alexander and Gen. Joseph W. ("We-took-a-hell-of-a-beating") Stilwell. By May most of Burma was gone, the Burma Road cut and China isolated. Western prestige had hit a new low in the Orient.

During this period of unrelieved Allied military disaster, the AVG and a handful of RAF planes performed brilliantly in local engagements but could do no more than impede the enemy advance. Bases were bombed out by the Japs and the Flying Tigers were pressed back into China. Always outnumbered and flying relatively slow aircraft, the AVG nevertheless hung up a phenomenal record during the seven months of its operational life: 298 enemy planes destroyed in combat for a loss of 12. This proved the soundness of Chennault's precepts, which were to fly in pairs, take one swipe at the enemy and get gone. It also punctured the balloon of invincibility growing up around the speedy, highly maneuverable Zero and proved that ruggedness, speed in dives, and firepower could be made to beat an enemy who, although a fancy dog-fighter, was not so rugged.

The 10th Air Force got a handful of planes in March, 1942. It had the *Fortress* and the LB-30 (early *Liberator*) with which Maj. Gen. Lewis H. Brereton and his party had flown from the Netherlands East Indies. It added six *Fortresses* and 10 *Warhawks* which had been scheduled for Java but which were diverted. With this tiny force it expected daily to have to help repel an invasion of India. But by May, 1942, this no longer appeared imminent so the primary mission of air in Asia then shifted from defense of India to aid to China. This meant ferrying operations over the Himalaya Mountains — the famed Hump route. A few planes from China National Airways and some DC-3s obtained via Africa and flown by commercial airline pilots started the operations. The first transport assignment was delivery of 30,000 gallons of gasoline and 500 gallons of oil, intended for Doolittle's April 18 raiders. By August, 1942, they had become the India-China Ferry Command, and on December 1 the Air Transport Command took over.

On the first anniversary of war, ATC had only 29 transport planes to fuel and supply the war in China. In all India the 10th had only 16 heavy bombers, 15 mediums and 50 fighters

operational. U. S. planes in China that day totaled 10 mediums and 50 fighters. These pathetic numbers were due partly to a diversion of reinforcements, partly to an actual withdrawal of planes to the Middle East, both in an effort to repel Rommel's drive on Egypt. The 10th lost all of its heavy bombers in this way and had none at all for some time. ATC grew the fastest. At first it carried gasoline, oil, and replacement parts to China-based aircraft. Gradually it started carrying heavy equipment. By October, 1943, a schedule of night flights over the stormy barrier peaks was added. By August 1, 1945, ATC was able to tally up a month's delivery of 71,000 tons—over four times the capacity of the old Burma Road—and it had stepped that up to a rate of more than 85,000 tons monthly in the final days of the war. Before it could begin to expand, however, it had to have bases. It had to get its own supplies, as well as those it was transporting to China, from harbors to the take-off point via air or inadequate rail, highway, and river transportation. Its planes in late spring, summer, and early fall flew in monsoon weather of rain, hail, wind and turbulence. In winter they flew through ice-laden clouds, piled high above the 18,000-foot Himalayan peaks. But they flew in ever-increasing numbers.

The AVG was absorbed into the 10th Air Force on July 4, 1942, and redesignated the China Air Task Force. Chennault, recalled to active duty as a brigadier general, was named its commander. In March, 1943, the China Air Task Force became the independent U. S. 14th.

Meanwhile, two British land campaigns were set in motion in Burma to combat the growing Japanese forces there which were threatening to drive across the Indian border and cut off the ATC bases now being built in Northeast India. Both these ground operations were on a limited scale. On the central front, Britain's Gen. Orde Charles Wingate infiltrated a brigade of jungle troops through the Japanese and for three months harried the rear areas while depending wholly on air supply. Farther south, in the Arakan, the British engaged in an orthodox, unsuccessful campaign.

Basing its decision on the experience of these two operations, the Quebec conference in August, 1943, approved plans for a determined drive the following year—a drive which was to utilize the lessons of 1943 and profit from a unified command, co-ordinating efforts of the 10th Air Force and the RAF Bengal Air Command under the Eastern Air Command, commanded by Maj. Gen. George Stratemeyer. As the India forces were depleted in 1942 to support the Middle East, they were reinforced from the Middle East once the African campaign was won. The 7th Bomb Group (H) was the one which was called out of India and it was sent back. The 12th Bomb Group (M), whose *Mitchells* had fought across North Africa, also was assigned to the 10th Air Force.

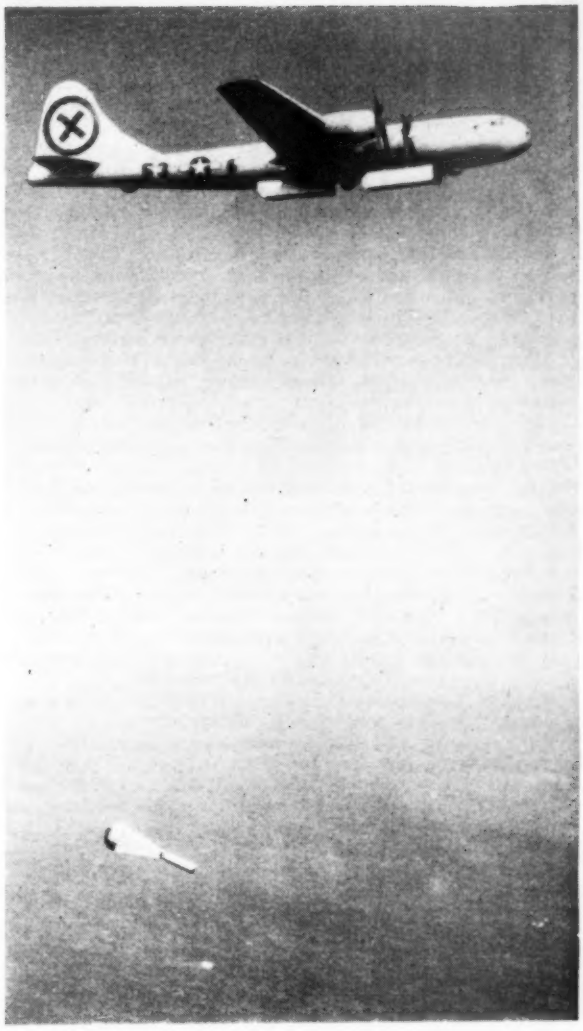
The push began in late 1943 with a limited British-Indian offensive into the Arakan. As it moved ahead, Japanese infiltration units struck the rear lines and cut communications. But unlike the previous year, the troops now were supplied by aerial drops from planes of Brig. Gen. William D. Old's Troop Carrier Command. They held, strengthened, and broke out of the trap.

Northward on the central front, a similar situation developed. Two British-Indian columns, moving out of Imphal, had been hit on the north and the south flanks by a major Japanese drive. The enemy pressed on, entrapping the British on the Imphal plain and posing a critical threat to the Assam-Bengal railway over which supplies were moved to Chinese-American forces building the Ledo road.

For the second time General Old's Troop Carrier Command came to the rescue. The 5th Indian Division, with all its mountain batteries and mules, was lifted into the Imphal area in 60 hours. Two brigade groups were flown to Kohima. Two hospitals and thousands of wounded and non-essential personnel were flown out. And, most important of all, food and ammunition were flown in.

The result was inevitable. The British troops had a secure air supply route while the Japanese had a land supply route which was under constant harrassment by combat planes. The threat to India was ended and these operations became the pattern for the ensuing campaign for all Burma.

Japan's forces in Burma were supplied by a long, slender rail-highway-river system, with only a few lines running north and south. The interdiction campaign in Burma was based on



The deadly trio which destroyed Jap merchant shipping was subs, bombs and mines. Here a B-29 is laying magnetic mines by radar.

the fact that with Rangoon and other south Burma ports under sustained air attack the enemy was forced to use Bangkok as his principal port. This meant carrying supplies on an additional stretch of rickety railroad running through miles of coastal country before they could be moved north. There were hundreds of bridges on this line. The solution, then, to denial of supplies to the enemy was to knock out the bridges and railroad trackage. This was done with regularity. The Japs were skillful at repair but our aircraft were able to keep ahead of the repair crews. Radio-guided bombs were used with excellent results, and *Liberators* even worked out a 25° dive angle technique which increased accuracy. The Jap supply problem became critical, and troops at the north end of the line eventually became starved and disease-ridden. These were the troops facing Gen. Stilwell's Chinese-American forces who were working their way ahead of the engineers building the Ledo road.

Air supply was vital to Stilwell's drive. A picked group of 3,000 volunteers—Merrill's Marauders—following the technique of General Wingate, struck off into the jungle as an advance spearhead probing toward Myitkyina. From February 23 until May 17—when Myitkyina airfield was taken—the Marauders were entirely supplied by air. Nearly 8,000 Chinese troops were flown over the Hump from Yunnanyi, China, in one operation, as front-line reinforcements for Stilwell's forces. By the end of October, 1944, 75,527 personnel had been flown

into North Burma, 7,693 had been shifted within the area, and 28,181 had been flown out.

In yet another 1944 operation an army was able to make a deliberate choice of entrapment through reliance on air. The 1st Air Commando Group under Col. Philip G. Cochran was organized to put General Wingate's troops inside Burma between Myitkyina and Katha, to supply them, to evacuate the casualties, and to sweep in front of the columns with bombers and fighters. The objective of Wingate's men was to cut supply lines in the rear of Japanese troops opposing Stilwell and Merrill.

March 5 was D-Day for Wingate and Cochran. Take-off time was set to put the gliders, with their cargoes of troops, airborne engineers, bulldozers and mules, over the secret jungle clearings of "Broadway" and "Piccadilly" just after dusk. So secret was the operation that the clearings were not reconnoitered for fear the Japanese would divine the intention and obstruct them. But, on a hunch, Colonel Cochran sent a photo reconnaissance plane out the afternoon of D-Day. Its wet prints were handed to him 15 minutes before take-off and he found that Piccadilly was a death trap. The Japs had covered it with logs.

Plans were changed swiftly to put the force down on Broadway alone and, with a postponement of only 30 minutes, the first wave of 26 transports, each towing two gliders, headed east. A second wave was dispatched, but all planes except one were called back because the landing field had become littered with gliders that had smashed up in landing due to overloading. Of the 54 gliders in the first wave, 17 did not reach Piccadilly because tow lines snapped.

Despite the losses and confusion, 539 personnel, three mules and 29,972 pounds of supplies and equipment were landed that first night. Airborne engineers went to work and by the next afternoon Broadway was ready for *Skytrains*.

Complete surprise had been achieved. A second field was set up the night after the first. Men and supplies poured in. By D plus 6, the total was 9,052 men, 175 planes, 1,183 mules and 509,083 pounds of stores. During the entire operation our bombers and fighters were masters of the air above Wingate's troops.

More troops and supplies were ferried to the fighting area. Lightplanes landed beside the advancing columns on hastily scratched-out clearings, to pick up casualties. The exact statistics on the "grasshoppers" will never be available because the commandos took literally General Arnold's injunction: "To hell with paper work; go out and fight." A reasonable guess is that they flew more than 8,000 sorties.

When the 20th Bomber Command's *Superfortresses* ended operations in China in late 1944 they turned their heavy loads loose in aid of the Burma campaign while awaiting a final shift to the Marianas. Singapore and Palembang were hit but blows against Rangoon and Bangkok were their principal assignments. In their first maximum-load attack each plane dropped 40 500-pound bombs, wiping out a Rangoon rail yard.

While the North Burma forces were advancing, British-Indian troops which had withstood the Jap attack at Imphal also took the offensive. Their advance was speeded by air leaps to airheads (airfields captured or built to keep supply bases near the advancing front). When on March 8, 1945, Mandalay and Lashio fell, the route to China was clear.

Rangoon remained. By 1945 it was almost useless to Japan but not until it was in Allied hands would the Burma campaign be ended. The British, with air lashing out in front of them, continued southward. Lieut. Gen. Sir William Slim, commanding the troops, radioed the 12th Bomb Group: "You have been a powerful factor in helping us give the little bastards a thorough thrashing."

By March, 1945, the southward-moving troops in Burma wholly dependent on air supply totaled 356,000. With the monsoon season near, it was decided to bridge the distance to Rangoon by a seaborne invasion aided by the whole weight of Allied aircraft. On May 1, Gurkha paratroopers jumped from *Skytrains*, swept meagre resistance aside, and the next day the seaborne troops piled ashore to find Rangoon abandoned. The Burma campaign was over.

All this time the 14th Air Force, which eventually included the Chinese-American Composite Wing, made up of U. S.-trained Chinese and AAF airmen, was ranging over China, assisted by a reporting net of thousands of Chinese. Initially it operated from bases prepared or planned before America's entry into the war. It gradually acquired new bases until finally there were 63 which the coolies had laboriously fashioned. Because of them General Chennault was able to shift his forces when enemy air or ground opposition became too threatening—as it often did—and employ them without delay against new targets.

Greatest of the bases was Chengtu. Its nine fields were built in 1944 in nine months by a peak of 365,000 workers who moved two million cubic yards of earth and laid two and a quarter million cubic yards of paving at a total cost of nine billion Chinese dollars. This was the *Superfort* forward staging base from which the first attack was launched on Japan. It also was the springboard for attacks on North China, Manchuria, and Formosa.

General Chennault's flyers had no connection with the *Superfortresses* other than defense of the bases. Their main duties were: protection of the Hump, close co-operation with China's armies and attacks on shipping and rail communications.

The 14th made up for its tiny size by reliance on deception, at which Chennault was a past master. He knew the capabilities, numbers and speeds of the enemy and by the judicious employment of feints and bluffs he used this knowledge to insure that he met the enemy where and when he wanted. Thus, even in the early days when he was greatly outnumbered, he often managed to have local air superiority and almost always managed to be *on top* of the enemy so that the high diving speed of his *Warhawks* would count. In one case, late in 1942, Chennault saw to it that Japanese agents got wind of an impending strike from a forward base against Hong Kong. The mission got under way on schedule; the Japs got set to defend Hong Kong. At the last minute, the U. S. force of eight bombers and 22 fighters, after apparently being on the way past Canton to Hong Kong, swung sharply into Canton and caught the off-balance Jap defenders coming up below them. Result: 22-23 Nip planes destroyed in the air and more on the ground; no American planes lost.

General Chennault's bombers ranged over the South and East China seas in quest of Jap shipping. Staging at East China bases for their missions, until these bases were lost early in 1945, they utilized to the fullest low-altitude radar bombing for night and low-ceiling attacks. They became the scourge of ships following the coast, gradually forcing them farther out where they became prey to U. S. submarines.

One of the 14th's most heart-breaking tasks was aid to China's armies. The Japanese always had enough—more than enough—land power to go where they would against the stubbornly contesting but ill-equipped Chinese. The 14th could, and did, impede the advances and make them costly. It could do little more, but in the final analysis that was enough. Japan's unwillingness to pay the price always saved China.

The first direct air aid to troops was in the late spring of 1943 when the enemy launched a limited offensive south and southwest of the Yangtze river in the Tungting Lake area. Only a few planes were available. About all that could be placed on the credit side of the ledger was experience for the pilots and bolstered morale for the overpowered Chinese. Later in 1943, seven Jap divisions struck at Changteh, southeast of Tungting Lake. This time they met stiffer ground resistance, heavier air attack from a stronger 14th Air Force. The Japanese had sufficient power to move ahead but they were looking for a cheap victory and this was not the place. They withdrew.

The high tide of the Japanese advance in China came in 1944. Between May and the end of the year the invaders, driving west from Canton and southwest toward Indo-China, severed East China from West China with consequent isolation of East China air bases, captured the air bases at Hengyang, Lingling, Kweilin, Liuchow and Nanning, and established a continuous line of communication from French Indo-China to North China. In early 1945 the Japanese seized all of the north-south rail line from Hankow to Canton, then pushed eastward and took the 14th's East China airfields at Suichwan and Kanchow. Loss of territory was nothing new to the Chinese; they had been giving ground since 1937. But evacuation and demolition of the laboriously constructed airfields and the necessary destruction of precious supplies was a bitter blow to them as well as to the 14th.

Although Chennault's men were driven from one base to another, operations against rail lines and freight yards, supply depots, airfields, moving troops and river shipping were carried on relentlessly. Throughout this period, as earlier, the incredibly vast Chinese information net was invaluable. When river craft assembled—and river shipping was an integral part of the transportation system—the 14th was advised. Its total tally of 24,299 miscellaneous river craft claimed sunk or damaged was the result. So effective were its rail attacks that Japan could neither fully use the lines she had nor extend lines which would have exploited the Indo-China link. From the days of the AVG, qualitative superiority in the air was always on the side of China. The 2,353 Jap aircraft destroyed and the 780 probably destroyed in China were never replaced in sufficient numbers to overcome the more effective fighter pilots, bomber crews, tactics and planes of the United States.

So complete was the aerial mastery that Japan dared not attack by day and its last inland night bombings were against Kunming in December, 1944. By April, 1945, all air attacks against American or Chinese installations had ended and the Japanese air force in China was an all but forgotten foe.

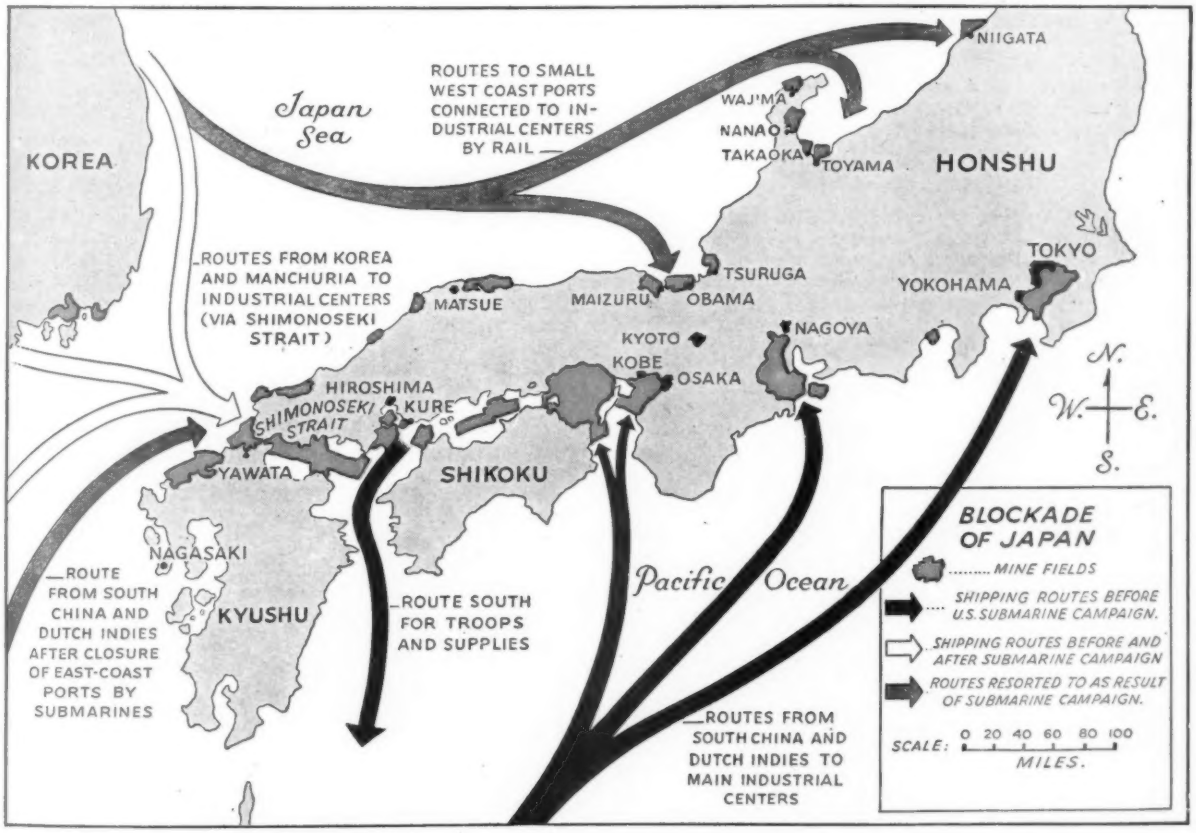
When Jap reverses in southwest China and in north Burma finally led to re-opening of the land route to China in the early spring of 1945, one of the tasks which had been set before our air power in Asia in 1942 had been accomplished. But the picture was no longer the same. ATC was flying into China a greater tonnage than the road could ever carry and the triumphant Pacific forces of the United States were pounding Japan from island and carrier bases. Japan, now, began to withdraw her forces from their points of deep penetration. As they moved back, they were pushed by the revitalized Chinese and hit by everything which could be thrown at them from the air. However, it was a planned withdrawal. Japan was through as an occupant of interior China. Her position in the war had deteriorated to a point where the occupation brought her returns that were continually diminishing.

The Japanese warlords' proud plans for Asia had been crushed when air power and land power were linked to turn back the thrust toward India and to re-open the Burma road. Their hope of substituting a land route for the effectively shattered sea route to the riches of the south faded when the 14th blasted their highways, railroads and river craft into uselessness. The value of China as a granary for them lessened as their cargo carriers, in ever increasing numbers, splintered from bombs and bullets. They were opposed by armies strengthened by airborne equipment and supplies. And, finally, having lost the air, their own armies were wide open to the most-feared fate of any ground force—constant, unchallenged attack by the opposing air force.

So the Japanese withdrew, moving north under pressure of ground and air forces. And the 14th in the final days of war shifted its attack to the targets far to the north which stood before the Soviet armies; targets that never were needed.

Blockading Japan

The blockade of Japan was, from the beginning of the war, one of the main objectives of American air and sea power. It was postulated on a set of conditions which were believed to make Japan at least as vulnerable to blockade as any great power in modern history. First, she was surrounded by water. Second, she had a huge population and depended on extra-territorial sources for at least 20 per cent of her food. Her nutritional standards were so low already that denial of this 20 per cent was expected to result in privation for a large part of the population. Third, much of her manufacturing potential was in the home islands, whereas most of the raw materials which her industries consumed were not. For example, 90 per cent of all oil came from overseas, 88 per cent of all iron and 24 per cent of all coal. Fourth, the bulk of her domestic coal supply was in Kyushu and Hokkaido, with the result that 57



The close-in blockade of Japan started when subs and mines virtually severed direct ship routes (black arrows) to east coast centers. Then mining, with some help from direct air attack, clogged Shimonoseki Strait, the Inland Sea, and vital west coast ports.

While we strangled Jap supply our big bombers massed in the Marianas to carry out direct bombing assaults upon the home islands. Squatting in their dispersal area at North Field, Guam, are Superfortresses of the 29th Bomb Group, 314th Wing, with planes of the 19th Bomb Group in the background. This view shows part of the southwestern part (upper left) of diagram pictured on next page.

per cent of *all* coal was water-borne at some point between mine and factory. Fifth, terrain and the comparatively poor development of the Japanese rail system made her very dependent, even for domestic transport, on coastal vessels.

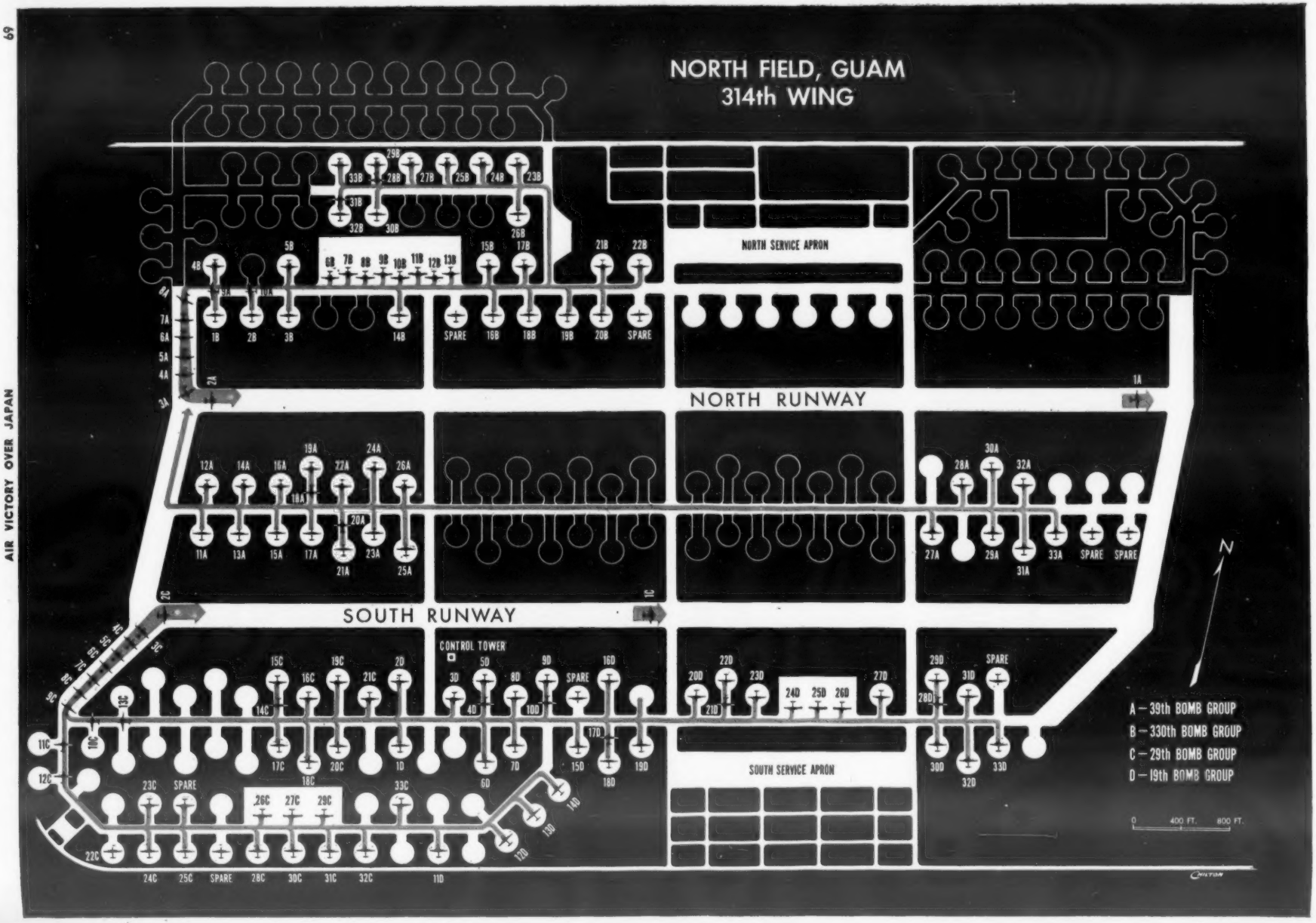
In short, Japan had to have a large and active merchant fleet if she expected to exist as an effective combatant. This fleet reached its maximum size in 1942. It consisted of about 5,000 vessels of over 100 tons each, and had a total gross weight of 7,500,000 tons. (No calculation has been made of the small coastal vessels, river boats and sampans of under 100 tons gross weight.) Because of the rapid expansion of Jap military activity to the south in the early days of the war this fleet was strained to the utmost and attacks by American submarines and aircraft were felt immediately. The 5th Air Force ravaged shipping lanes to the south, introducing, in the all-important Battle of the Bismarck Sea, low-level skip bombing by its *Mitchells*. This was a growing scourge until the end of the war. In the Southwest Pacific, the 13th Air Force developed a highly successful long-range snooper technique for its *Liberators*.

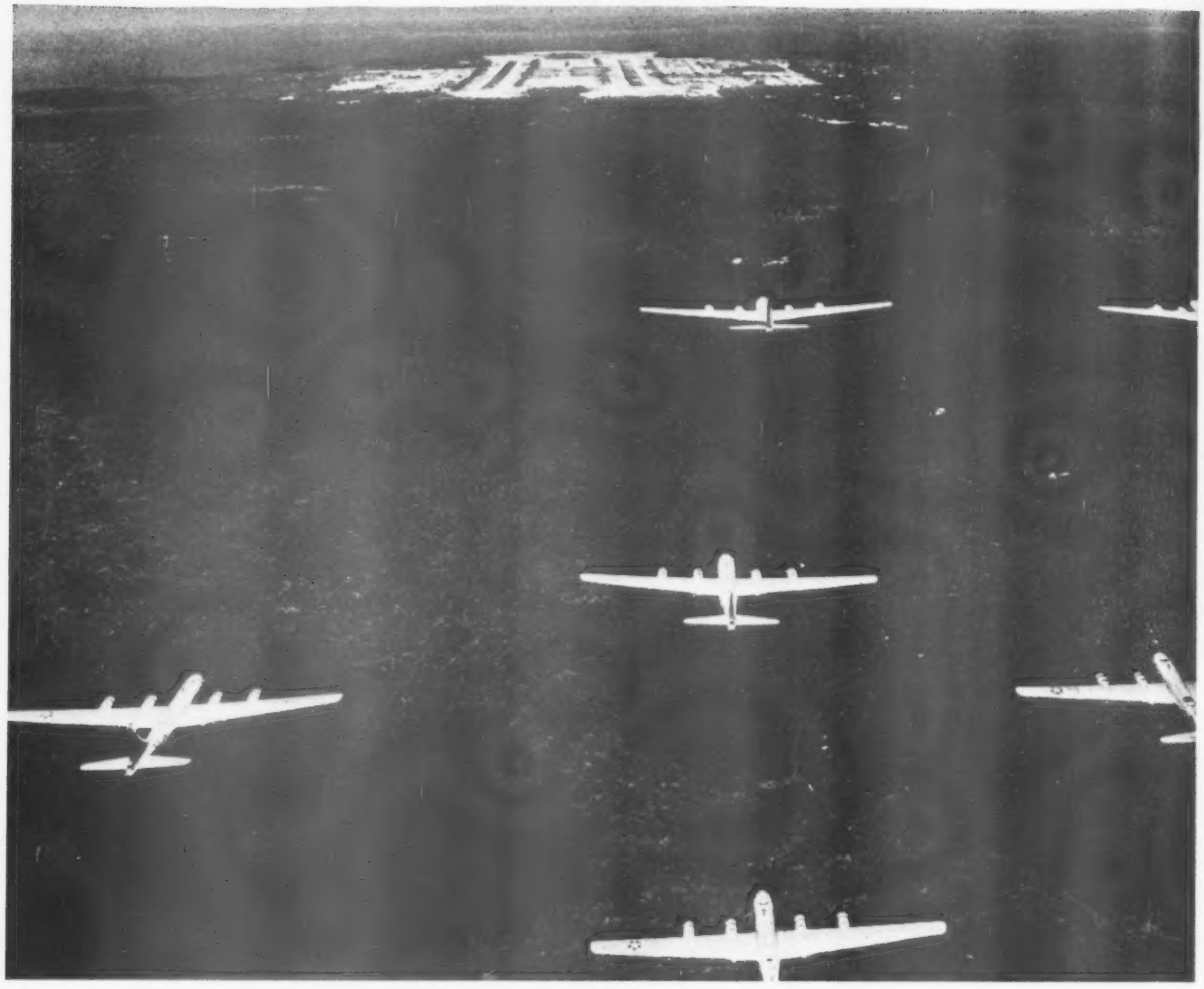
The 14th concentrated on river shipping and vessels traveling along the China coast, achieving notable success with a method for making low-level night strikes by radar. Carrier-based Navy planes sank ships everywhere. But the real vampire on Japan's jugular vein proved to be the submarine.. Day in and day out it chewed its way through more than 100,000 tons a month with relentless regularity. The effects of these attacks were manifold. They led to a general weakening of the Jap effort on the various southern and island fronts and eventually dictated a squatter policy in these places rather than one of aggressive military development. In addition to this they so restricted the delivery of raw materials to Japan that an increasing number of manufacturing plants was left idle. Finally, U. S. submarine depredations caused a virtual abandonment by cargo vessels of the great east-coast Japanese ports of Tokyo, Yokohama and Nagoya. This was more important than it sounds. It meant that a vast amount of shipping was now being funneled into a few places: the Shimonoseki Strait, whence it could proceed in safety up through the Inland Sea; and a handful of smaller ports on Japan's west coast, from which cargoes were transported to the manufacturing centers by rail. The first half of the job was now done. The aerial half remained. If we could clog up Shimonoseki and these west-coast ports with mines, Japan would almost certainly crumble rapidly as an organized industrial society.

It was not until the spring of 1945 that development of air bases within range of Japan had proceeded to a point where a mining campaign could be undertaken on the huge scale believed necessary for success. By that time Japan's merchant marine was down to about 2,500,000 tons. She had been completely unable to replace losses, and as the space in which her remaining ships could operate became more and more constricted the airplane became an increasingly terrible menace. In January, 1945, aircraft accounted for more than double the number of ships sunk by subs.

→

Diagram at right shows how one wing at North Field, Guam, took off on a typical "night burn job." At Zero hour plus one minute wing leader on No. 1 of the 39th Bomb Group (A) is airborne at the end of the north runway, while No. 1 of the 29th B.G. is halfway down south runway, 30 seconds behind. Others are lined up for green Aldis lamp signal. One by one they move out on exact schedule and taxi into position (follow the red arrows).


NORTH FIELD, GUAM
314th WING
NORTH SERVICE APRON
NORTH RUNWAY
SOUTH RUNWAY
CONTROL TOWER
SOUTH SERVICE APRON
N
A – 39th BOMB GROUP
B – 330th BOMB GROUP
C – 29th BOMB GROUP
D – 19th BOMB GROUP
0 400 FT. 800 FT.



Guam's North Field from the air, a wonderful sight to Superfortress crews returning from a 3,000-mile mission. Solution to the traffic problem at this field, described on page 68, has been called the "Miracle of the Marianas." Take-off procedure in daylight differed from that at night only in that each group used both runways to speed up its assembly into formation.

The first mining mission was flown on March 27 by *Superfortresses* which sowed 900 mines in the approaches to Shimonoseki Strait, Japan's greatest bottleneck and by that time, handling 40 per cent of all marine traffic. In the next four months over 12,000 mines were laid, completing the largest blockade in history, one that literally strangled Japan.

To complete the blockade of Japan started by the submarine, *Operation Starvation* (strategic mining of Japanese waters by *Superfortresses*) was commenced on March 27, 1945. The mines used were of two sizes: 1,000 pounds for water up to 15 fathoms, and 2,000 pounds for water up to 25 fathoms. All of them rested on the seabottom and could function properly in 10 feet of mud.

Mechanically, the mines were a marvel of ingenuity. Said one *Superfort* pilot, "The damned things can do everything but fry eggs." They could be equipped with a "ship count" device which permitted a specified number of ships to pass into their field of influence without causing detonation. This effectively foiled Jap minesweepers but was only used occasionally because it allowed some valuable tonnage to slip by. A "delayed arming" device permitted the mine to come alive only after a specified time had elapsed. Every mine was equipped with a "sterilizing" mechanism which rendered it impotent after a predetermined period.

The mining campaign was divided into five operational stages, described in the following paragraphs:

PHASE I: MARCH 27 TO MAY 2. This was planned in support of the Okinawa operation. By mining the great ports of Kure, Hiroshima, Tokayama (naval fueling point) and the big base at Sasebo, naval units which otherwise would have rushed to the defense of Okinawa, were blockaded. Equally important was the mining of Shimonoseki Strait, which prevented the enemy fleet from speeding to Okinawa through Shimonoseki and down the relatively safe western side of Kyushu.

PHASE II: MAY 3 TO MAY 12. Called the "Industrial Center Blockade," this phase severed all major shipping lanes between the great industrial cities which depended on water transportation for 75 per cent of their goods. The operation extended from Shimonoseki Strait east to Tokyo Bay, with particular emphasis on the vital Kobe-Osaka port system. Ship passages in the strait were reduced to two and four a day by the end of May, compared with 40 a day in March.

PHASE III: MAY 13 TO JUNE 6. The "minelayers" now went to work on ports in northwestern Honshu, even going as far up as Niigata, which the Japs thought was "too far north" for the *Superforts*. As a result, the heavy and direct ship routes to the Asiatic mainland thinned away to almost nothing. At the same time, the *Superforts* continued to pollute the Shimonoseki Strait. In fact, nearly half of all mines dropped during *Starvation* were earmarked for this bottleneck area.

PHASE IV: JUNE 7 TO JULY 8. Intensified mining of northwestern Honshu and Kyushu ports maintained the blockade.

The great port system of Kobe-Osaka was also mined repeatedly, as these ports were offering repair facilities to wounded Jap shipping which was constantly attempting to limp through the Inland sea.

PHASE V: JULY 9 TO AUGUST 15. To complete the blockade, mines were dropped again on major harbors of northwest Honshu and Kyushu, and as a final touch the *Superforts* mined Fusan, on Korea's southern tip, and other Korean ports. On August 6 only 15,000 tons of operational shipping were photographed at Fusan, whereas over 100,000 tons had been spotted there a few months earlier. Ship losses for Phase V were estimated to be in excess of 300,000 tons. Only a trickle of traffic still flowed from the continent to Japan. *All raw material shipment had ceased* and the shipment of food was only a fraction of that required.

As for the aircraft score, a total of 1,528 *Superforts* were airborne to lay 12,053 mines in the targets—with the loss of 15 aircraft. In a unique operation, demanding the utmost precision and navigational skill, the 313th Wing of the 21st Bomber Command, and particularly its 505th Group, had made possible the first strategic mining blockade in military history.

Operational Growing Pains

Behind every combat mission flown by the *Superfortresses* lay an incredible amount of training, planning, sweat, sacrifice, and guts. This informal report touches only a few random details of the story. If they jostle together incongruously—a general's courageous decision next to a sergeant's silver dollar—it can only be pointed out, perhaps platitudinously, that life itself is incongruous and final values are seldom known.

The history of *Superfort* operations in the Pacific can be dated from the arrival of the first bomber, an event which a corporal in an air service group celebrated in a lengthy ballad. It began:

THE FIRST B-29

On the thirteenth of October back in nineteen forty-four
The citizens of Saipan heard a great four-motor roar.
Bulldozers fled the runway, and soldiers stopped to cheer
As down came "Joltin' Josie—the Pacific Pioneer."

And all the Japs still lurking in the cane fields and the caves
Peered out in fear, and ghosts of Japs were peering from
their graves.
Their plans for co-prosperity they knew they'd have to cancel
As out of "Joltin' Josie" bounded General Haywood Hansell.

In stanzas that are somewhat less flowing, but historically accurate. the corporal told how the first air service groups had moved in two months earlier, built roads out of crushed coral, hauled supplies, set up maintenance equipment on the line *"to be ready for the coming of the first B-29."* In full detail he designated Brigadier General Hansell as the commander of the 21st Bomber Command, told of the long training period in high-altitude flying over the plains of Kansas, the six shakedown missions over Truk and Iwo, the three famous recon missions of Tokyo Rose, and ended up with the first Tokyo attack on December 24 when 111 *Superfortresses* at Isely Field, Saipan, took off on the 1,500-mile-long "Hirohito Highway" to bomb the Musashino aircraft engine plant.

The No. 1 problem was weather. Japanese weather showed its hand right from the start. On the first Tokyo mission only seven per cent of the bombs were dropped on the target, due to heavy cloud cover. (Radar was an invaluable aid to navigation, but it could not at that time insure precision from high altitudes.) During the first two and a half months that the 73rd Wing, commanded by General O'Donnell, carried on alone, its bombing results were far from decisive. But this was a period of courage and dauntless perseverance, when problems were discovered, diagnosed, and solved, a period as essential to the ultimate success of the 20th Air Force as a firm foundation is to a fort.

Indicative of the 73rd Wing's fighting spirit is the fact that in 10 days, starting with its debut over Tokyo, the Jap capital was walloped four times—and this despite the hazards of blazing a new air route, flying a new and not fully perfected type of aircraft. Once it had started, the Wing kept punching to the limit of its strength.

The Japs struck back. Shortly after midnight November 27, when the *Superfortresses* were lined up on Saipan's runway to launch at dawn their second Tokyo strike, Jap raiders sneaked in to bomb and strafe the base. One *Superfort* received a direct hit. It exploded and damaged other aircraft on adjacent hardstands. But the mission was run as scheduled.

Radio Tokyo was broadcasting threats of *Kamikaze* rammings. These seldom materialized but they were a source of some anxiety to our crews. Jap fighters appeared to be bamboozled by the high speed and heavy armament of the *Superfort*. Almost all of their effective attacks were head-on. At high altitudes they didn't have enough speed differential to attack from any other quarter. And even in head-on attacks, with a closing speed of more than 500 m.p.h., the *Superfort* could usually dodge its attackers by a quick flip of the wing.

Jap fighters found they could do better by waiting until some *Superfort*, crippled by flak, lagged behind its formation, and then, like vultures pouncing on wounded prey, chase it 50 or 100 miles out to sea. In most cases, though, the plane got away.

Journey's end for this Superfort, which crashed after engine failure at take-off and was converted into a diving platform.

"Shepherd" Superforts escorted Mustangs on fighter sweeps to Japan. Here, a waist gunner watches a trio flying close in.

This policy of attacking stragglers continued throughout the war. It was counteracted by our "Buddy System," in which one *Superfort* would fall out of formation to defend the crippled plane and, if it had to ditch, circle above the survivors, dropping life rafts and directing air-sea rescue units to the scene. Sometimes an entire formation would slow up in order that a limping *Superfort* could keep pace.

Fighter attacks, however, grew more and more fierce and accounted for most of our losses over the target. (At very high altitudes flak was generally too inaccurate to be effective.) During the first five high-altitude strikes (28,000 to 33,000 feet) on the Mitsubishi aircraft plant at north Nagoya, the *Superforts* were met by a total of 1,731 fighter attacks. Our gunners shot down 48, probably destroyed 50 others. And on the Wing's 14th strike against the Jap homeland on January 27, "fighter opposition of unparalleled intensity was met." Combat reports go on to tell how "fanatical hopped-up pilots pressed their attacks right down the formation's stream of fire, dove into formations to attempt rammings, and sprayed fire at random." Five *Superforts* went down over the target. Two ditched on the way home, and 33 returned with battle scars. In turn, the *Superforts* on this same mission destroyed 60 Jap fighters.

"Fuji in '44" became the name of a select group of airmen who had used the famous Japanese mountain as a check point. Pictures of *Superfortress* formations against snow-capped Fuji appeared as often in the Marianas as pictures of Niagara Falls in oldtime parlors.

Greatest hindrance to bombing accuracy was the high winds over the target. At 30,000 feet, high wind velocities up to 230 m.p.h. were met, causing ground speeds as high as 550 m.p.h. when bombing downwind. These velocities were far beyond the maximum provided for in the AAF bombing tables. Moreover, the crews were often subjected to extreme cold when the pressurizing system in their planes was knocked out by enemy fire. This gave rise to a grim quip having to do with a remedy for fleas. "Take your fleas with you over Japan, and stab them with an ice pick."

But by now one fact was clear: the *Superfortress* could take it. It had come through its baptism of fire, had felt the full force of Jap fury and Jap weather. It was a superb combat weapon.

By now, also, it was clear to any observer that the strategy for bombing Japan would follow much the same pattern as in Germany. And this was to bomb aircraft production first. As set forth in FM 100-20 on the Command and Employment of Air Power, "The gaining of air superiority is the first requirement for the success of any major land operation."

Before any priority targets were selected, however, intelligence material was culled from every conceivable source. In marked contrast to the European theater, where U. S. target specialists could benefit from British intelligence and where the Germans themselves, with their zeal for documentation, had published volumes of facts and figures about their resources, wartime Japan was virtually *terra incognita*.

Planning war for many years, the naturally secretive Japanese had taken extra pains that their plans should not be known. In one of history's greatest fact hunts, information had to be pieced together from reports made by missionaries, commercial travelers, former residents of Japan, U. S. engineers who had been hired to build Jap plants, even from snapshots taken by American summer tourists. Added to this were the first reconnaissance photos taken back in the spring of 1944 by 20th Air Force pilots whose daring China-based photo missions, flown by single *Superfortresses* deep into enemy territory, were among the war's most heroic deeds.

Starting with this remarkable compendium, much of it still valid, two committees met in Washington: the Committee of Operational Analysts and the Joint Target Committee. They compiled a list of 1,000 precision objectives. From this the Joint Chiefs of Staff picked out Jap aircraft production, the coke, steel, and oil industries, shipping, and the Japanese industrial urban areas as major targets. The final priority list was drawn up by the C.O.A. in this order: (1) aircraft industry, (2) urban industrial areas, (3) shipping. A broad directive was issued to the 21st Bomber Command, saying in effect, "Here are the types of targets. Now the job is up to you."

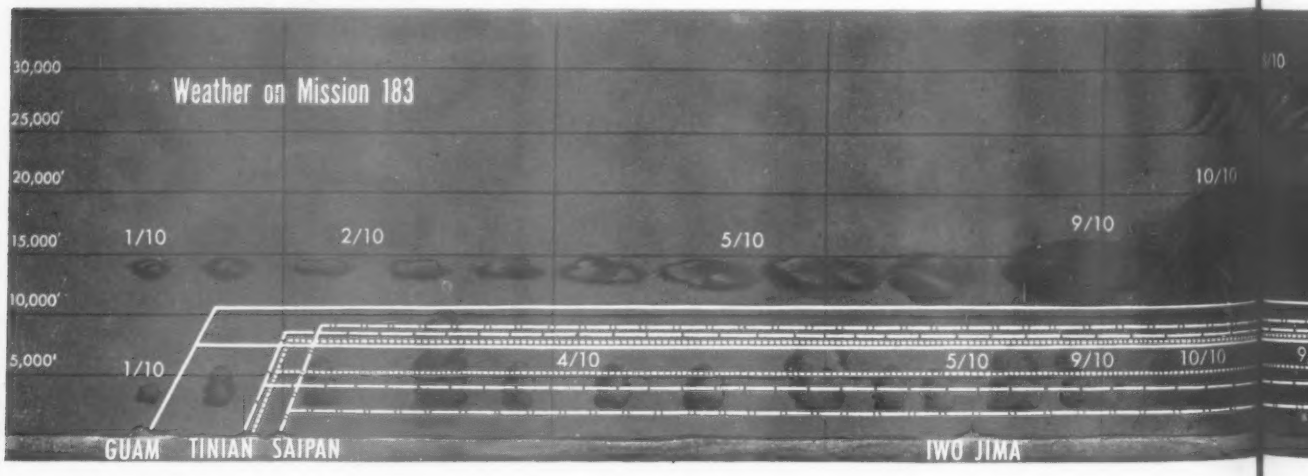
To transmute a general Washington directive into specific orders for individual bomb crews in the Marianas required still a vast amount of work. In rough outline, this is what happened.

The job was assigned to target specialists of the Bomber Command's A-2 (Intelligence), co-operating closely with A-3 (Operations). Their most crucial need was for detailed, up-to-date facts about specific targets and the routes thereto. These had to be obtained largely from aerial photos. Starting in November, 1944, and operating out of the Marianas, the 3rd Photo Squadron ran almost daily missions to Japan, flying *Superforts* modified for camera equipment. Guns, incidentally, were not sacrificed. By August 1 the squadron had completed 433 such missions and had photographed literally every square mile of Japan. Here were the eyes of the B-29ers—the advance echelon of eyes

Once the film was printed the PIs (photographic interpreters) got busy. They scrutinized each print through magnifying glasses, spotted enemy defenses, landmarks, analyzed targets, even estimated what kind of building materials were used so that the bomb experts would know what type of bombs could do most damage.

Armed with such data, the A-2 and A-3 men at headquarters then proceeded to lay out specific missions.

The technique of planning a mission evolved with practice. Eventually, a planning meeting was devised, an informal round-table gathering of veteran operations officers, along with specialists on targets, navigation, weather, enemy fighters and antiaircraft defenses, radar, radio, armament, ordnance, and chemical warfare. Pure theory was not represented. These were men who from first-hand flying experience "knew what the hell it was all about."



Together they drew up a kind of blue print for each mission. It told the force required, bomb loads, routes and altitudes to and from the target, navigational check points, aiming points, axis and altitude of attack. These missions were then submitted to the commanding general for his approval, and wrapped up for future use.

Immediately, however, each complete "blue print" was sent to the A-2 at each wing headquarters. Called a fragmentary plan, it was a tip-off, a forewarning of what missions might be coming up, any time from three days to three weeks. Several such plans might be submitted at one time.

Thanks to this advance warning, the wing A-2s could assemble most of the data for a mission—maps, charts, and so on—and keep them on file until more specific orders were issued. This system also enabled the wings to recommend target studies, based on the fragmentary plan, for their own respective bomber groups. In other words, it enabled the airplane crews to do homework on possible future targets, instead of depending entirely on the final briefings.

Headquarters staff also benefited by the system. They were not committed far in advance to bomb any single target. They could cut their cloth according to last-minute requirements. Had they been committed and, for example, had the targets been "socked in" by bad weather, it would have meant sitting idle until the weather improved. Now there were alternate targets to pick from, and the entire air force was ready to roll on any one of them.

Final orders from the 21st Bomber Command were issued by the commanding general in two installments.

1. INTENTIONS, usually one or two days ahead of a mission, clinched the target, authorized the wings to have their groups prepare all material for briefings, and to haul bombs.

2. FIRM DECISION, 12 to 24 hours ahead of a mission, was issued to the wings after the final weather forecast. It usually included the date and hour of take-off, and gave authorization to load bombs. All this was passed on to the groups.

Each wing issued its own field orders, which included the order of take-off for each group. The group A-3 then prepared a schedule, known as a flimsy, which was handed to every airplane commander, stating the exact time and order of take-off for each individual aircraft within the group.

Thus each pilot, with his briefing and target study in mind, and with his target folder and flimsy in hand, was ready to bomb Japan, backed up by the knowledge and experience of many thousand men. In the deepest sense, the 11 crewmen in *a Superfortress* did not fly alone.

Boomtown in the Marianas

Meanwhile, a pattern of living had begun to take form and with minor variations repeated itself on all three islands: Saipan, Guam, Tinian. The battered remnants of Japanese occupation were pushed aside. The Age of the Bulldozer had dawned. Seabees and aviation engineers pitched their pup tents in the morning near some clump of trees for a landmark, and at nightfall they couldn't find their way home. The landmark was gone. The bulldozers had been around. Acres of jungle were unrooted in a few hours, making way for new air strips and bivouac areas. What once looked like a tropical paradise on a tinted postcard took on the character of all American pioneer settlements—shanty towns, lumber camps, gold rush towns.

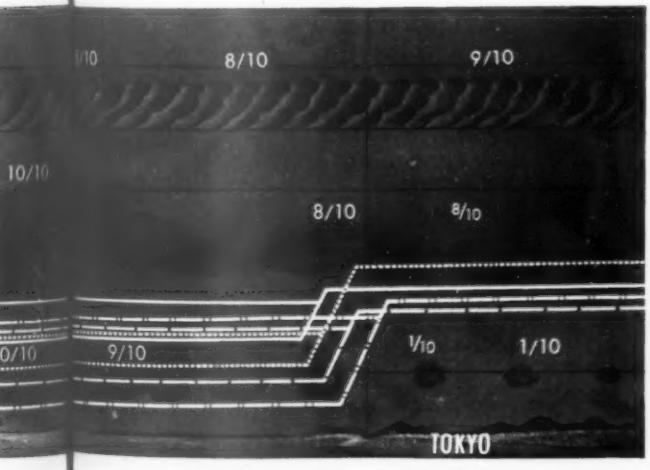
Twin-engined Nick scuttles by Superfort wing during head-on attack over Tokyo. Generally fighter attacks were not serious.

By April Guam's Route No. 1 became what is practically the symbol of America: a straight paved road, lined with telephone poles, and jammed with traffic. You felt that such a highway must lead to a big city. The road had other plans. Riding northward on Route No. 1, you came to a rise, and then suddenly it was spread out before you; North field with its two 8,500-foot runways, its miles of taxi strips and hardstands, covered by a sea of *Superfortresses*, their rows of wings shining in the sun, their tail rudders arching up like surf. It was a satisfying way for one highway to end—and another to begin.

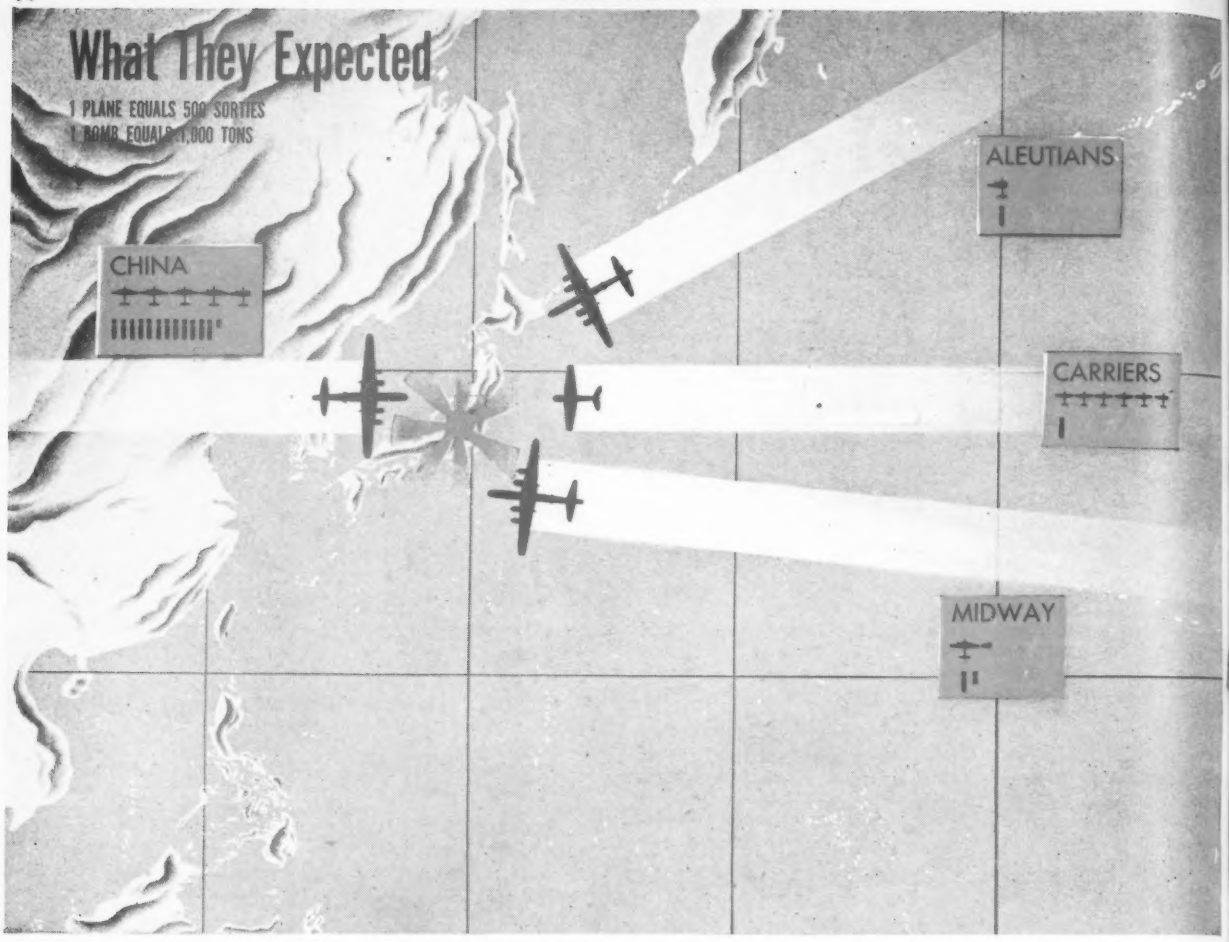
A take-off at North field is scheduled for 1900 (7 p.m.). It is a maximum effort job, involving all four groups of one wing, or about 140 planes. Ground crews, officers, enlisted men line up on the mounds of coral along both runways. Two by two, the planes begin to take off, slowly at first as if they could never raise their tremendous bulk. As each set of wheels finally leaves the ground each man feels a sense of relief. In less than an hour, the entire group is airborne. Tail lights dwindle into the clouds and the last planes are out of sight. Not out of mind.

Sweating out a mission is an Air Force rite. Different men do it in different ways, some by playing poker, or waiting for radio reports, or trying to sleep and forget. But nobody quite forgets. A ground crew member who is charged with keeping a certain No. 3 engine in perfect condition, and has named it after his wife, is sweating out all 18 cylinders of No. 3. A colonel who briefed a group of enemy fighter opposition wonders whether his briefing will save or cost lives. Not all sweating is done on the ground. The crews in the air are thinking ahead about the few minutes over the target. A bomber outfit is full of thinkers.

So seldom do these inner emotions produce any outer evi-



Mission 183, one of the costliest—and most profitable—B-29 raids, encountered the weather indicated in chart. Fractions indicate amount of cloud cover, white lines show altitudes of each of the four wings. Smoke forced planes to bomb by radar.



In January, 1944, alarmed by the invasion of Tarawa, Jap intelligence officers began speculating on the likelihood of bombing attacks against Japan. This chart has been prepared from basic information contained in their estimates of what was to come.

dence, that when they do it is worth noting. There was one target known as "Old 357," or "General O'Donnell's Pet Little Target." It was the important Nakajima aircraft plant near Tokyo. To destroy it became the special job of the 73rd Wing on Saipan, and the target seemed to be jinxed. They bombed it on 13 different missions. at a cost of 58 planes. On the nights before the later missions were run to Old 357 the barracks where the crew members slept were quiet and dark as usual. There was only the meagerest evidence of what was going on in their minds, while they took the bomb run over and over again, while they weighed their chances of living or dying. It was a row of cigarettes glowing in the dark.

Iwo, Haven for Superforts

To every *Superfort* crew who flew to Japan after March, the fact that Iwo Jima had become a U. S. base was a cause for thanksgiving. Iwo is eight miles long—a very little island. But never did so little mean as much to so many. Located about midway between Guam and Japan, Iwo broke the long stretch both going and coming. If you had engine trouble, you held out for Iwo. If you were shot up over Japan and had wounded aboard, you held out for Iwo. If the weather was too rough, you held out for Iwo. Formations assembled over Iwo and gassed up at Iwo for extra long missions. If you needed fighter escort, it usually came from Iwo. If you had to ditch or bail out, you knew that air-sea rescue units were sent from Iwo. Even if you never used Iwo as an emergency base, it was a psychological benefit. It was there to fall back on.

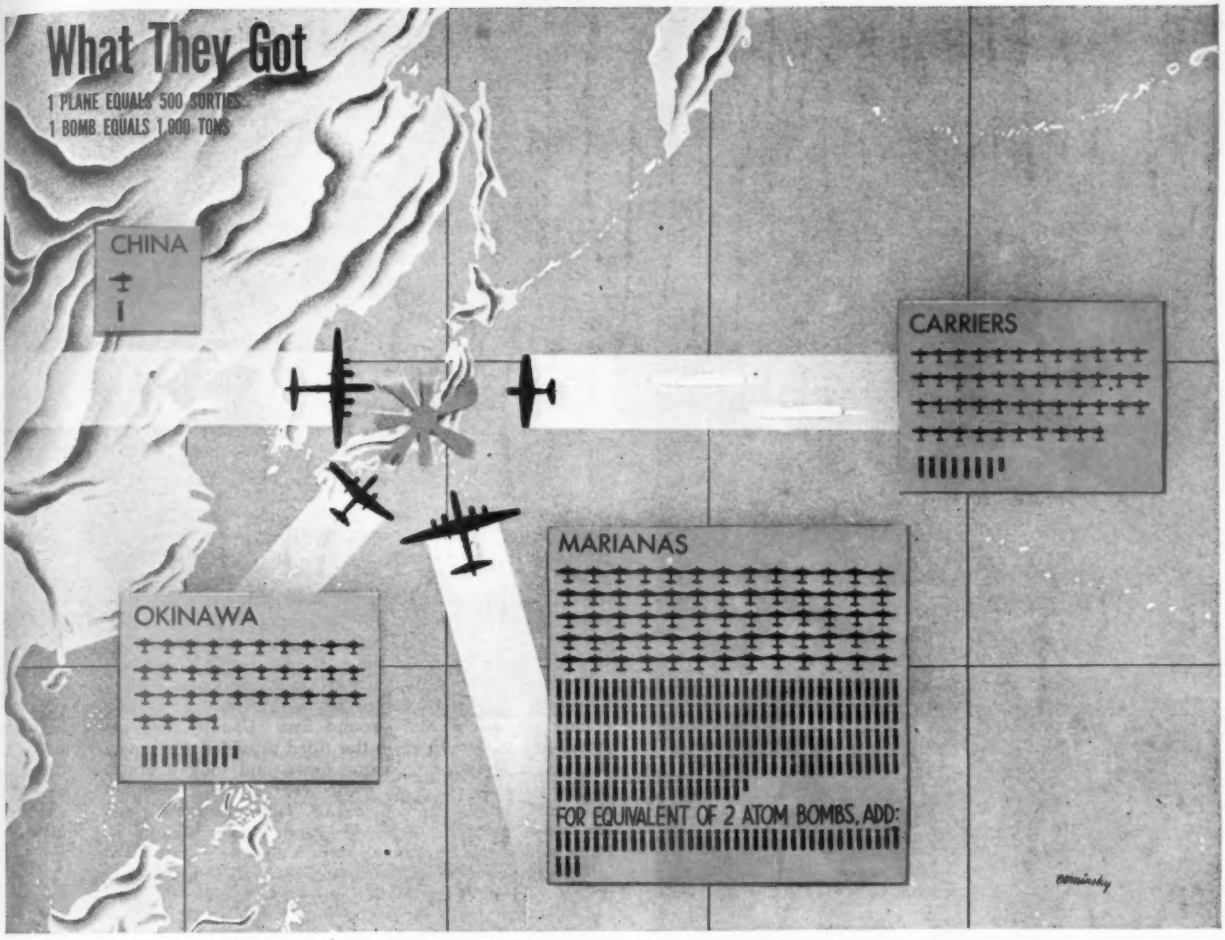
From March 4, when the first crippled *Superfortress* landed there, to the end of the war, 2,251 *Superforts* landed at Iwo. A large number of these would have been lost if Iwo had not been available. Each of them carried 11 crewmen, a total of 24,761 men. It cost 4,800 dead, 15,800 wounded, and 400 missing to take the island, a terrific price for the Navy and Marines to pay but one for which every man who served with the 20th Air Force and 7th Fighter Command is eternally grateful.

Iwo started with a crude dirt runway that barely accomodated the first *Superfort*, which was refueled by gasoline carried in the helmets of Marines. At war's end it had an elaborate system of black-top runways, gas pumps and machinery which could handle scores of *Superfortresses*.

This is where Maj. Charles A. (Rocky) Stone came in. They called him chief of B-29 maintenance but it was easier to see him as the operator of "Rocky's Wayside Service Station," the most important drop-in-and-fix-it station in the world. Rocky is an ex-navigator who got his Iwo job by telling a colonel in the States, "Sir, I think your maintenance section stinks." A produce trucker from California, Rocky, with his square, stubble-bearded face under a billed cap and a hunk of tobacco always clamped in his jaw, looked the part of a big-time shop foreman.

In the grand strategy of the Pacific war, Iwo Jima was expected to serve primarily as a base for fighter-escorting *Superforts*. As stated above, it served the *Superforts* even more importantly. But it did become the base for the 7th Fighter Command, which made combat history in its own right.

Pilots of the 7th flew some of the longest, toughest missions ever undertaken by a fighter outfit. They had to fly in weather that earned every foul name in the Army's lexicon of abuse. Jack-knifed into the cramped cockpits of their *Mustangs*, they flew for eight or nine hours over 1,600 miles of sea, for only a



What did come emphasizes the complete failure of the Japanese to forecast either the scale or the direction of the aerial onslaught launched against them. They expected 75 per cent of the bombing effort from China, actually got less than one per cent.

few minutes' strafing of enemy airfields and other targets. "It wasn't so bad after the first hour because your legs got numb," said one pilot. "But when you got home, you didn't feel much like sitting. You were raw."

The *Mustangs* started moving to Iwo early in March. The first chores were aid on Iwo itself to the still embattled Marines, and neutralizing raids against Jap positions in the nearby Bonins. As all-around trouble shooters, the *Mustangs* often found that trouble had evaporated before they had much chance to shoot at it. The expected Jap attacks on Iwo seldom materialized. In part, this was because the presence of fighters scared them off and partly because, with the loss of Iwo and the threatened loss of Okinawa, the Japs decided to pull in their horns and concentrate on *Kamikaze* attacks.

On April 7 the Fighter Command began what presumably was to be its No. 1 assignment. One hundred and eight *Mustangs* took off to escort B-29s on a daylight mission to Tokyo, and proved their usefuless at once by shooting down 21 Jap fighters at a loss of only two *Mustangs*. From that date until the Jap surrender, 10 escort missions were flown. This relatively small number was due to the sudden increase of night incendiary attacks for which no escort was required.

The fighters' real foe, as always, was weather. On June 1, as they returned from escorting *Superforts* on a daylight incendiary attack on Osaka, 24 *Mustangs* were lost in a frontal area extending from the surface to 23,000 feet, with zero visibility, heavy rain, snow and icing conditions. What these planes went through, battered and tossed in a seething cauldron of black weather, nobody will ever know. Two more fighters collided and crashed. One pilot from the 44th Fighter Squadron spent six days in a one-man raft and was knocked out of the raft five times by waves. He was finally picked up by a submarine, which by pure luck happened to be surfaced. On his fifth day he weathered the typhoon which ripped the bow off the cruiser *Pittsburgh*. His only comment on the ordeal was, "I just sat there."

On April 16 the command began its series of sweeps on Jap ground installations and for the first time was in business for itself. Altogether, it was able to launch 33 effective strikes and was going strong when the war ended, a partner of the much bigger and, of course, more powerful Navy carrier air forces.

There is no question that these attacks helped deny the Japs the use of airfields in the Tokyo-Nagoya-Osaka area, while the Okinawa-based fighters did likewise for the Kyushu-Shikoku area. The Japs were forced to camouflage their planes under trees, in revetments, in cemeteries. Planes were parked as far as five miles from airfields, which meant that by the time a plane had been taxied to its field its engines had become so overheated that it couldn't be flown for awhile. This enforced dispersal complicated the Jap maintenance problem tenfold—and the Japs at best were never too good at maintenance. From the fighter pilot's viewpoint it was discouraging sometimes to get all the way to Japan and not be able to rip into a sitting duck.

With airfields knocked out, railroads, power houses, factories, and coastwise shipping became prime targets of opportunity.

As a sidelight, it is interesting to note that the Japs appeared to have no adequate aircraft warning facilities. Our fighters were continually catching Japs running for cover, jumping off bicycles, piling out of trains and trucks, even running from

Typical scenes on the 3,000-mile, 14-hour Superfort missions: top, chow includes vegetables, sandwiches, canned juice; center, beginning bomb run, pilot switches to autopilot as bombardier adjusts sights; bottom, bombardier relaxes on trip home.

tennis courts. It became a court martial offense to strafe civilians and non-military targets such as isolated houses, silos, hospitals, schools.

The success of the fighter strikes depended to a large extent on licking the navigational problem. This involved a reversal of the standard procedure of fighters escorting bombers and required that the *Superforts* be used as escorts.

The tactical unit for the *Mustangs* was the group, which consisted of three squadrons of 16 planes each, plus two spares per squadron. The fighters took off two at a time, with 15-second intervals between each pair, and fell into formation about five miles offshore, then proceeded to the rendezvous point at Kita, a pinpoint volcanic island about 40 miles north. There the group joined three navigational *Superforts* which had taken off from Iwo about a half hour earlier, and were circling over Kita until the fighters pulled in.

It was the job of the big planes to lead the little ones across the 600-mile stretch of sea to Japan, giving them the benefit of their superior navigational aids, and standing ready to drop rescue equipment in case a fighter was forced down. The lead squadron of the fighter group flew about a quarter of a mile behind the *Superforts,* and other formations followed close after.

Thus chaperoned, the fighters proceeded to the Departure Point, usually about 20 or 30 miles off the Jap coast, and then struck off by themselves to attack the target. Meanwhile, the *Superforts* proceeded 50 or 100 miles to the Rally Point, where the fighters were expected to reassemble after the strike. For the *Superforts,* it was simply a case of circling the Rally Point for a half hour or longer, waiting for the scrappy small fry to come back—if they did.

It was customary for each group to concentrate on only one target at a time, in order to provide mutual protection against enemy air attack and ground fire. Usually two squadrons attacked the target, while the third provided top cover. Then the covering squadron came down and took a crack at the target, while another squadron went upstairs. But the group as a unit always stuck together. After the strike, the planes proceeded by units of not less than a pair back to the Rally Point where the *Superforts* were waiting.

The rounding-up of the fighters was expedited by a system of plane-to-plane radio telephone communication, which enabled one or more groups of fighters to be in constant touch with their navigational guides. (This same system links the fighters with air-sea-rescue units, and has been responsible for saving the lives of many pilots lost in bad weather or forced down at sea.) The fighter pilots and their *Superfort* guides are like characters in a vast combat drama, making their entrances and exits as they careen through the clouds at lightning speed, speaking lines that sound like double-talk but are often a matter of life or death.

What follows here is a snatch of dialogue that might be heard as the fighters approach the Rally Point after an attack on Himeji airfield. The code names are fictional, but follow closely the actual names. The characters: 48 fighters called Small Fry; divided into three squadrons known respectively as Doctor, Lawyer, Merchant; three Navigational *Superforts*—Uncle Adam, Uncle Bill, Uncle Charles; a Super Dumbo (air-sea-rescue B-29) known as Cartwheel.

When our action starts, the fighters are just returning to the Rally Point about 20 miles off Japan, where the three *Superforts* are orbiting, waiting to guide them home.

UNCLE ADAM (the lead B-29): Any more Doctor ships approaching the Rally Point? Give Uncle Adam a call.

UNCLE CHARLES: Uncle Adam, this is Uncle Charles. I have seven Doctor ships with me, and 10 Lawyers. I'm proceeding home on a 185 course.

UNCLE ADAM: All Small Fry coming into the Rally Point: Uncle Charles has just headed on course 185. Follow him. (Five more Small Fry join Uncle Charles and start home. A few minutes later Uncle Bill rounds up 13 Small Fry and also starts home. Uncle Adam waits for three stragglers.)

DOCTOR RED ONE (a fighter): This is Doctor Red One calling Cartwheel. (Cartwheel is one of the Super Dumbos, a B-29, circling a submarine posted at one of the Air-Sea-Rescue stations. Due to faulty communication, Cartwheel does not hear the fighter's message.)

UNCLE ADAM: Doctor Red One, this is Uncle Adam. I'll relay your message to Cartwheel 42.

Fire from incendiary bombs gutted areas of Tokyo shown in red. The city suffered a loss of 56.34 square miles, or 39.9 per cent of its total area. In all Japan, according to Radio Tokyo on August 23, 2,210,000 houses were demolished or burned, leaving 9,200,000 persons homeless—approximately half of the 1940 population of the 69 major cities we selected for aerial attack.

The second largest city of Japan, Osaka, had 35.1 per cent of its area, and 25 per cent of its identified industry, including 50 per cent of its aircraft industry, destroyed by B-29s.

Toyama, once a big industrial center for aluminum, burns on the night of August 1. The city was 95.6 per cent demolished by Superfortress attacks—mostly middle-altitude incendiary strikes.

One atomic bomb obliterated the center of Hiroshima and left only a few gaunt and gutted structures amidst its wasteland.

DOCTOR RED ONE: My engine's smoking from flak hit. I'm at Silver Moon, seven Zero (code for his location) Going to splash.

UNCLE ADAM: Roger. (He switches to a special Air-Sea-Rescue radio channel.) This is Uncle Adam calling Cartwheel 42. Splash at Silver Moon, seven Zero.

CARTWHEEL 42: Roger. Proceeding to scene of splash.

DOCTOR RED TWO (wing man to the fighter in trouble): Calling Cartwheel 42. Man in Goodyear (rubber life raft), same position. I'm circling scene with Rooster showing Mayday.

(This last remark refers to his IFF system which will help guide Cartwheel 42 to the scene. Again, Uncle Adam relays this message to Cartwheel 42. Within 10 minutes Cartwheel 42 arrives over the man in the rubber raft, and then calls a submarine to the scene. Uncle Adam continues his business.)

UNCLE ADAM: (Picking up the last two Small Fry.) This is Uncle Adam calling all Small Fry. I'm heading home on course 360 Follow me.

For the *Superfort* pilots this escort work may sound like a comparatively easy assignment. They did not run into much combat. But most of them would far rather have faced combat and been spared the worry and strain of shepherding a flock of fighter pilots who had become their close friends. "Hell," said one *Superfort* pilot, as he came back to Iwo after two fighters had been shot down over Japan. "You live and eat with these boys. You take their money at poker. You know all about them. That's why—" He didn't feel like talking any more.

Fighters were also aided by radar-equipped *Black Widows* who, in addition to patrol and combat duties, often guided *Mustangs* onto Iwo's runways when they were socked in.

Returning from a mission, pilots usually retired to a bath house built especially for fighter clientele. Here was a rub-down table and a row of deep tin tubs. The tubs were fed by hot, sulphurous water that springs from Iwo's volcanic depths. Hot water is an almost unheard-of luxury in the Pacific. After soaking their muscles in these curative baths, U. S. airmen had still another reason to thank God, and the Marines, for one of the world's most ugly, useful islands.

Turning Point: Gen. LeMay's Great Decision

On January 20, Maj. Gen. Curtis LeMay took charge of the 21st Bomber Command, with its headquarters on Guam. He had left Europe in 1944 to assume command of the India-based *Superfort* operations, two months after they had started. Now he had left India to assume command of *Superfort* operations in the Marianas two months after the first Tokyo mission. A *Superfort* can run into a good deal of trouble in two months.

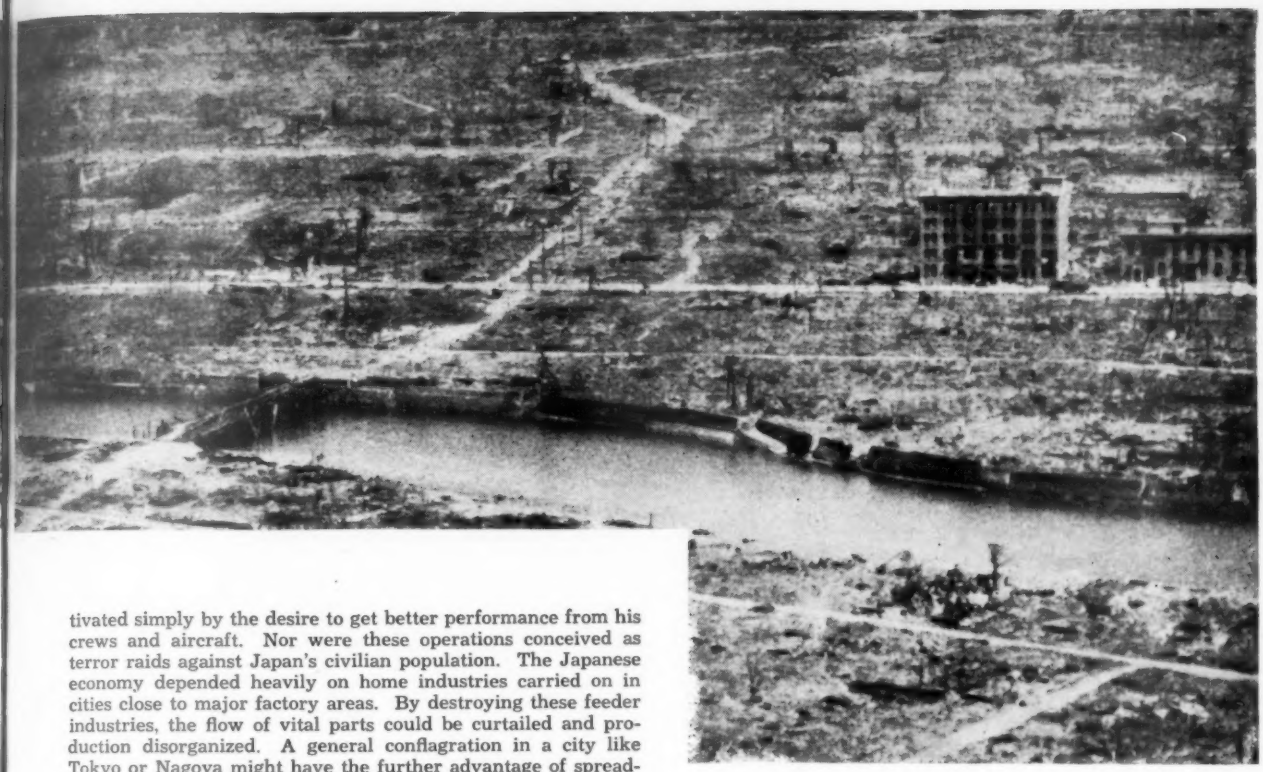
In China the main trouble had been distance, supply and to some extent, weather. In the Marianas it was largely weather. Due to treacherous, unpredictable weather, not one of the 11 priority targets was destroyed in the first 2,000 sorties. A third of the total effort had been spent on Musashino—Target 357—and it was only four per cent destroyed. There was only one opportunity for visual bombing during General LeMay's first six weeks at Guam.

Even when good weather prevailed over the target, the *Superforts* often had to battle their way through severe fronts on the long overseas flight. Formations were scattered and many crews missed the briefed landfall by a considerable distance. With a small fuel reserve on high-altitude missions, errors in navigation were sometimes impossible to correct and aircraft were forced to return early or bomb a target of opportunity. An added obstacle to navigation was the fact that Jap-held islands en route could not be used as check points for fear of alerting the enemy radar system. But the toughest problem, as mentioned earlier, was the terrific wind velocity at high altitudes over Japan. True, some crews were able to hit the target consistently. But they were an exception, proving that more than average training and unusual aptitude were needed to do the job (a lead crew school was started in an effort to discover and train such leaders). Another result of the high-altitude attacks was the cumulative strain on men and equipment. Long formation flights shortened engine life, contributed greatly to crew fatigue.

Against this background of poor conditions and poor results, it was decided to depart radically from the traditional doctrine of strategic bombardment. Just how radically was not known to most of the flyers until the memorable morning of March 9 when in all briefing rooms throughout the Marianas an announcement was made. It was followed by a sudden, shocked silence as the crews began to realize what they had just heard:

1. A series of maximum effort night incendiary attacks were to be made on major Japanese industrial cities.
2. Bombing altitudes would be from 5,000 to 8,000 feet.
3. No armament or ammunition would be carried and the size of the crew would be reduced.
4. Aircraft would attack individually.
5. Tokyo, bristling with defenses, would be the first target.

In making this daring decision, General LeMay was not mo-



tivated simply by the desire to get better performance from his crews and aircraft. Nor were these operations conceived as terror raids against Japan's civilian population. The Japanese economy depended heavily on home industries carried on in cities close to major factory areas. By destroying these feeder industries, the flow of vital parts could be curtailed and production disorganized. A general conflagration in a city like Tokyo or Nagoya might have the further advantage of spreading to some of the priority targets located in those areas, making it unnecessary to knock them out by separate pinpoint attacks.

Incendiary operations were not new. Several trials had been made. On some attacks a mixed load of HE and incendiary bombs had been used with indifferent results. On three missions prior to March 9 incendiaries alone were used. According to the Phase Analysis reports, from which much of the foregoing data was assembled, these results, too, were indifferent. This was partly because the ballistic characteristics of incendiary clusters rendered them inaccurate when dropped from high altitudes in strong wind, partly because not enough *Superforts* had been available for a major strike against a big urban area. But by the start of March the 313th Wing had joined the 73rd Wing as a fully operative unit, and two groups from the 314th, recently arrived on Guam, were ready for action. Thus, the combined force now totalled more than 300 aircraft—enough to strike a spark.

One main advantage in lowering the altitude to between 5,000 and 10,000 feet was the increased bomb load. A single *Superfort* flying in formation at high altitude could carry only 35 per cent of the possible bomb load of the same plane attacking individually at the lower altitude. This was made possible, of course, because individual attacks required no assembly over the base at the mission's start or reassembly on route to the target. Aircraft would go directly from base to target and return, thus saving gas and allowing a greater bomb load. Better weather would be encountered at the lower altitude, and the heavy, gas-consuming winds of high altitudes would be avoided. The weight of extra crew members, armament and ammunition would go into bombs. With the largest bomb load carried to date to Japan, each *Superfort* would bear six to eight tons, largely the new M-69 fire bomb, composed of an incendiary cluster containing a jelly-gasoline compound. It was felt that the weakness of Jap night fighters justified the elimination of armament.

Time was a crucial element in the new plan.

Jap night fighters were known to be weak, but flak losses were expected to be substantial. By making a night-time attack it was hoped to minimize these losses, since enemy radar gun-laying devices were thought to be comparatively inefficient and heavy AA guns would thus have to depend on searchlights for effective fire control.

It was found that the best time for take-off was around dusk, so that the planes could benefit by at least some daylight for the getaway. This brought them to the target just before dawn, and, most important, enabled them to make the homeward flight by daylight, thus avoiding night ditchings of battle-damaged aircraft.

Finally, these missions had to be completed in time for the *Superforts* to co-ordinate their efforts with the naval strike at Okinawa. Since the first of the Okinawa operations was scheduled for March 23, only a little more than two weeks were available in which to hit the four big targets—Tokyo, Nagoya, Osaka, Kobe.

Viewed in retrospect, it appears that almost everything was in favor of the low-altitude night attacks. Nevertheless, it took extraordinary courage to risk 300 unarmed aircraft on a new type of attack directly opposed to the traditional doctrine of high-altitude precision bombing for which the *Superforts* had been expressly designed.

Probably no mission, except the first historic ones against Yawata and Tokyo, was sweated out with more anxiety than the March 9 strike on Tokyo. This time, in the event of failure, nobody could claim that we were pioneering against an unknown enemy. This time the risk of men and equipment was many times greater. This time it was later in the game and the need for decisive air action was more acute than it had been during earlier strikes.

On the afternoon of March 10, when one by one the *Superforts* returned to the Marianas, the verdict became known. Pilots told how Tokyo "caught fire like a forest of pine trees."

A few hours later came the photographic evidence. Sixteen and a half square miles of Tokyo had gone up in smoke. Eighty-five per cent of the target area was destroyed. And this included 16 targets which were numbered for pinpoint attacks. Out of 302 aircraft over the target, 14 were lost—the largest loss suffered on any of the five missions.

Less than 36 hours later the *Superforts* were off again, to Nagoya. During this strike the crews peered down on what "looked like a gigantic bowling center with all the alleys lighted up; each flight had left an alley of flames." But the scattered fires never joined to create a general conflagration

and final results were not too good. A total of 1.56 square miles was destroyed. Nagoya was unfinished business.

Osaka. Kobe. These were next on the timetable. On March 13 more than 300 *Superfortresses* destroyed 8.1 square miles of Osaka, and on March 17 2.4 square miles of Kobe, including 11,000,000 square feet of dock area, were reduced to cinders. Fifth and last attack in the series was made on the return trip to Nagoya when again more than 300 *Superfortresses* dropped some 2,000 tons on the city. Over-compensating for the scattered bombing on the previous attack, the bombs were dropped in too small an area, and only .65 square miles of the city were destroyed. But nobody doubted, least of all the Japs, that the blitz was a holocaust. In five missions more than 29 square miles of Japan's chief industrial centers were burned out beneath a rain of bombs that totaled 10,100 tons. By comparison, on the *Luftwaffe's* greatest fire raid on London, only 200 tons were dropped. And on the 8th Air Force's record strike on Berlin (February 3, 1945) over 1,000 heavy bombers made a 1,000-mile round trip to drop 2,250 tons. During the 10-day blitz, nearly this same tonnage was carried on each mission by only 300 *Superfortresses*. The round trip exceeded 3,200 miles.

Our losses to AA and fighters were less than 1.3 per cent of aircraft over the target, and they were soon to drop even lower. Greatest source of alarm to our flyers were the terrific thermals, or hot air currents, that rose from the blazing targets and sent our aircraft into a black hell of smoke (no losses were ever attributed directly to thermals). One plane commander related what happened over Osaka: "We headed into a great mushroom of boiling, oily smoke and in a few seconds were tossed 5,000 feet into the air. It was a jerky, snappy movement. The shock was so violent that I felt I was losing consciousness. 'This is it,' I thought, 'I can't pull out of it.' Smoke poured into the ship and every light was blacked out. It smelled like singed hair, or a burning dump heap. Everybody coughed. We were tossed around for eight or 10 seconds. Flak helmets were torn off our heads. The ship was filled with flying oxygen bottles, thermos jugs, ear phones, latrine cans, cigarette lighters, cans of fruit juice. We dropped down again with a terrible jolt, and in a few more seconds pulled out into the clear."

Discussing the morale of the B-29ers after the blitz, one report said, "The phenomenal success of our new tactics had precipitously salvaged the morale and fighting spirit of our crews by providing a degree of battle success proportionate to the effort expended . . . Amazingly, the number of cases of flying personnel disorders due to flying, which had increased steadily prior to March 9 fell off sharply after March 19, 1945." Cases were reduced from one per cent of the total flying personnel to *two-tenths of one per cent*, or a total reduction of 80 per cent.

If our crews were encouraged by the low losses and good results of this initial phase, they truly hadn't seen the half of it yet. More and more *Superforts* were put on the job. Tail guns were reinstalled for minimum protection. Fighter escort was available, if needed. In May and June forces of 400 planes, and more, were launched against the big targets. By June 15 they were so completely destroyed, that the *Superforts* started a new campaign against more than 60 of the smaller industrial cities. Losses continued to nose dive. In June the average *Superfortress* loss rate per mission was .08 per cent. In July it was .03 per cent. In August it was .02 per cent. In the Marianas a low altitude incendiary attack on Japan was considered to be about the safest pastime a man could enjoy.

Ruining Japan's Economy

Japan's ability to continue the war finally collapsed amid the ashes of her burned-out cities. Her industry, blockaded and bombed into a shambles, finally could not longer support a large, modern war machine. This situation was caused by the *Superfortress*, which, in the final phase of the war, was the decisive factor.

The final phase was swift. President Truman's announcement of the surrender came 157 days after the 20th Air Force first cut loose with fire bombing. In those 157 days, the main strategic air weapon literally wrecked the enemy nation.

Our intelligence analysts rubbed their hands with anticipation when they examined Japanese industry. Here was no dispersed, well-organized system like Germany's. They knew that only a few vulnerable target areas had to be obliterated before Japan would be on the ropes. A study of her cities showed that the wood and plaster buildings were a set-up for area incendiary bombing. Only 10 per cent were made of stone, brick, metal or reinforced concrete. Many modern factories were hemmed in by solid masses of flimsy workshops, the very homes of the workers themselves. Peacetime conflagrations had been frequent in Japan; this had not been true of Germany. Water supplies, never adequate, were dangerously low for large-scale fire fighting. In addition, our experts discounted all talk about Japan's ability to survive through her Manchurian industry alone. They were convinced that once the heart of the Empire had been gouged out, she was licked.

On the basis of these facts, the bombers of the 20th Air Force went to work. Their success is, if anything, considerably understated here because information is still incomplete in many instances.

For one picture of what happened to Japanese industry, here are some estimates of factory space destroyed by both area and precision attacks in 12 major war industries, listed in order of their importance:

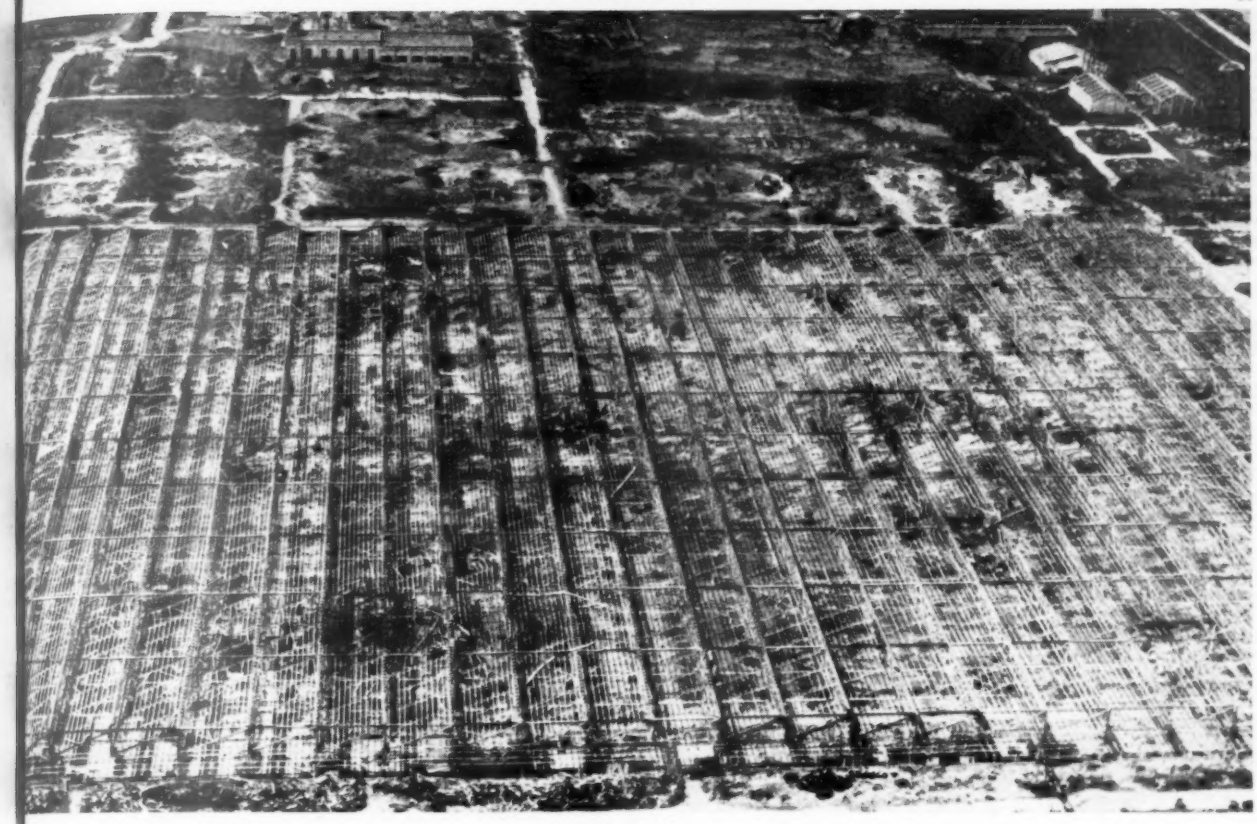
Industry	Pre-attack Plant Area in '000s of sq. ft.	Industrial bldgs. destroyed or badly damaged
Aircraft	140,000	37%
Ordnance	110,000	15%
Shipbuilding and repair	45,000	15%
Oil (including storage)	150,000	5%
Electrical equipment	40,000	28%
Machinery and finished metal prod.	110,000	33%
Metals (ferrous and non-ferrous)	150,000	14%
Chemicals	130,000	9%
Rubber	30,000	17%
Textiles	50,000	24%
Mil. and Gen. storage area	200,000	12%
All others	445,000	20%

Industrial damage totaled 288,000,000 square feet. Of industry in the 69 cities blitzed, 27.4 per cent was badly damaged. Yet this fails to tell a complete story. Many undamaged factories were of no use because the blockade and bombing of supporting industries denied them the necessary materials to fabricate Likewise, it is impossible to translate physical plant damage into specific production loss. On the basis of what we learned in Germany, where fire bombing was much less successful than it was in Japan, the percentage of production loss for six weeks after incendiary missions was sometimes double the percentage of space destroyed. The Japanese, in contrast to the Nazis, did almost nothing to repair damage. They cleared up rubble inside bombed-out plants, then abandoned them completely. Other factors contributing to loss of output were: (1) shortages of materials; (2) transportation interruptions; (3) lowered worker morale; (4) absenteeism; and (5) administrative disorganization. All these probably added up to an actual percentage of production loss nearly double the percentage of physical plant damage.

Important results in some instances are hidden in the table above. Oil target areas are reported as only five per cent destroyed. However, due to the fact that most production was confined to a relatively few modern facilities, the 315th Wing, by concentrating on 11 of Japan's newest refineries, reduced over-all oil output by 30 per cent in little more than a month of operations. Synthetic production sagged even more sharply with a drop of 44 per cent, which represents an actual loss of some 265,000 barrels.

As in the case of Germany, the first target system of fundamental importance was the aircraft industry which was treated to both high explosive and incendiary attacks. Against this type of target, the fire bombing was even more effective than had been anticipated. Many large structures were consumed by flames which gave added dividends by ruining machinery that possibly could have been salvaged if subjected to HE only. Despite our attention to this industry, Japan still had plenty of planes at war's end so one might assume that the B-29 effort was a wasted one. It was not, and for very simple reasons.

On August 1, 1945, Jap monthly production was estimated at 1,834 combat planes. This figure was 75 per cent of their production for December 1944, before bomb damage became appreciable. It indicates that by some dispersal, use of excess plant capacity and production in hidden sites (including a small number of underground shops), the Japs, like the Ger-



The Mitsubishi aircraft engine factory at Nagoya produced 40 per cent of all Japanese combat aircraft engines. The B-29s hit it seven times and it finished the war only six per cent intact. Our primary bombing objective always was Japan's war industry.

mans, were still able to produce a sizable number of aircraft despite our prolonged attacks. Also, they had *planned* a considerable increase in production.

The 20th Air Force expended 45.5 per cent of the 15,000 tons it dropped on the aircraft industry against aero-engine plants. Another 49.5 per cent went on airframe assembly plants. This probably denied the JAF between 6,400 and 7,200 planes through July, 1945. These, if it had been possible to employ them as *Kamikazes* at Okinawa, might well have delayed the outcome of the war.

Strangely enough, a portion of the remaining five per cent dropped on subsidiary aircraft industries by the 20th, plus extremely successful fire attacks against Osaka and Shizuoka, would have hurt the Japanese most during the balance of 1945. The Sumitomo propeller plants at Amagasaki, Shizuoka and Osaka, making 70 per cent of all the propellers used on first-line Jap combat aircraft, suffered 60.5 per cent damage, which, together with same damage to the Japan Musical Instrument Co. propeller plant in Hammamatsu, curtailed propeller output sufficiently to cause a five month production loss. It is estimated that the resulting bottlenecks would have forced aircraft production down to 41 per cent of its January 1, 1945, rate by November of 1945. Cumulative effects would have begun to be felt seriously just at the time our invasion was scheduled. It undoubtedly was one of the factors that convinced the Japs that the situation was hopeless.

Though aircraft continued to be No. 1 priority, other industries received an ample share of attention. Shipbuilding had dropped 60 per cent by V-J Day, partly due to the fire bombing of Kobe, Osaka, and Yokohama, but principally because of steel shortages. Ordnance, a particular pet of the 20th, was cut 40 per cent. Iron, steel and coke, the key heavy industries of war, were down 56 per cent primarily because of the blockade, but also partly due to bombing. Aluminum output slumped 35 per cent. Military and industrial storage areas also suffered heavily as a result of the incessant bombing.

Unlike the bombing program for Germany, where transportation rated top priority along with aircraft and oil, we had not yet reached the stage where it was necessary to concentrate on rail targets. Japan's rail system, incidentally, like her industry, was far more vulnerable than Germany's. Not until August 14, the last mission of the war, did the *Superforts* hit a Jap rail target. Nonetheless, the fire blitzes had an amazingly potent effect on land transport. Together with depreciation of already poor rail equipment, they cut railroad traffic to less than half the volume of a year before. With coastwise shipping also disrupted, the Japanese were faced with what was admittedly their worst economic bottleneck. This was the most important by-product of the incendiary attacks.

Many lesser industries contributing to the Japanese war economy also were heavily affected by *Superfort* bombing. Electronics equipment production, already insufficient to supply demands, was down 35 per cent. These in turn were badly needed for repairing bombed-out factories and for retooling damaged machinery. The little factories of 30 workers or less, where the Japanese produced components for delivery to larger assembly plants, took a terrible beating from area attacks. Just as the experts predicted, they were wiped out by the thousands in all the big cities.

Tokyo, Osaka, Nagoya, Yokohama, and Kobe caught 44.1 per cent of all 20th Air Force tonnage. Serious damage to identified industry ranges from 25 per cent in Osaka to 43 per cent in Nagoya. The aircraft industry within these cities suffered 50 per cent damage. Ordnance and metals were lowest at 21 per cent. Kobe's industrial area was 41 per cent obliterated. So thoroughly gutted were most sections of the "Big Five" (their burned areas totaled 103.22 square miles), that they were no longer considered essential targets except for occasional pinpoint "policing" attacks.

Once they had taken care of the big fellows, the *Supers* relentlessly went after the Toledos and Bridgeports of Japan. In all, 69 cities were treated to "burn jobs." On the basis of

available photo coverage, 175 square miles of urban area were wiped out. Here is what the Tokyo radio announced on August 23 concerning casualties from air attacks in the home islands; 260,000 killed; 412,000 injured; 9,200,000 homeless; 2,210,000 houses demolished or burned, and another 90,000 partially damaged. Though these figures may not be entirely accurate, they compare favorably with estimates of our analysts who say that housing for 10,548,000 persons was destroyed. This is 50.3 per cent of the 1940 population in the 69 cities. Considering that half the population in the industrial centers was de-housed, the effect this had upon labor morale and absenteeism must have been enormous. The completeness of the chaos was reflected in the breakdown of all administrative controls. Workers lacking orders from higher up, were hamstrung.

Wide variations exist in the percentages of pre-attack industrial area damaged with the 69 cities. Fukuoka, with only .6 per cent, Takamatsu with 89.3 per cent represent two extremes. Damage to residential structures ranges from 9.1 per cent for Nishinomiya to 98.2 per cent for Toyama. Impressive as these figures are, again they fail to tell the whole story. The "planned target area" was much smaller than the built-up urban area in nearly every case. Thus, after the last great fire mission to Tokyo on May 25, some 86 per cent of the "planned target area" had been eliminated.

The Atom Bomb

With two shuddering jolts, at Hiroshima and Nagasaki, the war skidded to a halt. Soldiers the world over, their jaws agape, began to wonder how the sudden crazy shift of military values would affect the familiar patterns of conflict. A few things are clear. The atom bomb will not, at one blast, wipe out navies or ground armies, as has already been widely proclaimed. That it will change them almost beyond recognition is without question. But they will remain. Warfare has existed in many forms since men first banded together to destroy men, but it has always been waged in *all* the elements over which man had some control—or, more correctly, in which he could move freely. For a long time all battles were on land. Later they were on land and water. When man began to exercise control over the air, war moved into the air too. There now remains only "under the ground." It may be that atomic power will force future military strategists to fight in that dimension also. But they will never fight in that, or any dimension, alone.

Since atomic explosives were first used by the Army Air Forces, and used conventionally (i.e. in the form of a bomb dropped by conventional methods from a conventional aircraft), it may seem that air will be less affected than land or water. This is not so. The single fact that atom bombs are 2,000 times as powerful as ordinary bombs eventually will make present-day air forces obsolete. Until now they have depended largely on size for their ability to crush a city or an industrial system. In the future a handful of planes will theoretically do the same job—provided they can get to the target. The inevitable improvement of antiaircraft defenses will probably force future bombers to fly at great heights and speeds. The aircraft we know cannot fly as high (even with the reduced loads made possible by atomic explosives) or as fast as theory already requires. If improved ground defenses or air defenses do not demand increased altitude and speed improvement in the efficiency of atomic explosives probably will, to ensure that a bomber is not caught in its own bomb's blast. All this will mean fundamental changes in the design of aircraft. These may be difficult to engineer (for example, getting adequate lift out of a supersonic airfoil).

Consider for a moment the simplicity of military organization and effort required to wreck two large Japanese cities. The two bombs which fell on Hiroshima and Nagasaki were dropped by the 509th Composite Group, part of the 313th Wing of the 20th Air Force. It had its own Troop Carrier Squadron, Ordnance, and Technical Service Detachment, nothing else except about a dozen scientists who arrived in Tinian on July 4. The Hiroshima mission was flown on August 5. Two planes participated in it, one to carry the bomb, the other to act as escort. It went off without a hitch. Bombing was visual. On the second mission, the same two planes participated, but their roles were reversed. This time weather caused a great deal of trouble. According to Maj. Charles W. Sweeney, pilot of the plane with the bomb, "The navigator made landfall perfectly. We passed over the primary target but for some reason it was obscured by smoke. There was no flak. We took another run, almost from the IP. Again smoke hid the target. 'Look harder,' I said to the bombardier, but it was no use.

"Then I asked Comdr. Frederick Ashworth (Naval adviser to the project) to come up for a little conference. We took a third run with no success. I had another conference with the commander. We had now been 50 minutes over the target and might have to drop our bomb in the ocean. Our gas was getting low—600 gallons were trapped. We decided to head for Nagasaki, the secondary target. There we made 90 per cent of our run by radar. Only for the last few seconds was the target clear."

Japan Was Through Anyway

Although some Japanese have been trying to sell the world on the idea that it was the atomic bomb and Soviet war declaration which forced them to surrender, there is now abundant evidence to the contrary, much of it from the lips of high-ranking and informed Japanese themselves. The following testimony tells with stunning emphasis that Japan was utterly finished as a war-making nation before the first atom bomb was dropped.

The most interesting and most complete statement comes from Prince Higashi-Kuni, speaking before the Japanese Diet on September 5: "Following the withdrawal from Guadalcanal, the war situation began to develop not always in our favor. Especially after the loss of the Marianas islands the advance of the Allied forces became progressively rapid while the enemy's air raids on Japan proper were intensified, causing disastrous damage that mounted daily.

"Production of military supplies, which had been seriously affected by curtailment of our marine transportation facilities, was dealt a severe blow by this turn of the war situation, and almost insuperable difficulties began to multiply, beginning with the spring of this year . . . With the loss of Okinawa and the consequent increase in the striking power of the enemy's air forces, even communications with the China continent were rendered extremely hazardous . . . As regards railway transport, frequent air raids, together with depreciation of rolling stock and equipment, brought about a steady lowering of its capacity and a tendency to lose unified control . . . Moreover, various industries suffered directly from air raids which caused huge damage to plants and lowered the efficiency of workmen. Finally the country's production dwindled to such a point that any swift restoration of it came to be considered beyond hope." On September 14, Higashi-Kuni further said, "The Japanese people are now completely exhausted." He estimated that there were 15,000,000 unemployed in the home islands, and called the *Superfortress* attacks the turning point in the war.

Rear Adm. Toshitane Takata, ex-deputy chief of staff of the Japanese Combined Fleet, also saluted the B-29: "*Superfortresses* were the greatest single factor in forcing Japan's surrender. These planes burned out Japan's principal cities, reduced military production by fully 50 per cent and affected the general livelihood of the Japanese people."

On the sudden cessation of enemy air activity after the end of the Okinawa campaign, General Kawabe, Commanding the Japanese Army Air Forces, had the following to say: "It was to combat invasion that we hoarded all our aircaft [5,000-plus planes remained operable at war's end], refused all challenge to fight the Third Fleet, the city-destroying Superfortresses, and the hard-hitting FEAF which was blasting targets on Kyushu during the last six weeks of the war. But while we waited, the air war was carried to such extremes of destruction, including use of the atomic bomb, that the Emperor decided to capitulate on the basis of the Potsdam Declaration." When questioned about *Kamikaze*, Kawabe replied, "We had to do it that way. We had no other way to use our pilots."

One of Tokyo's district fire marshals stated: "After the first big incendiary attack I realized that our system of fire prevention was utterly helpless in stemming attacks of such magnitude."

Among industrialists, war manufacturer Chickuhei Nakajima stated that Japan had been so wrecked by bombardment that it would take from two to five years for her to get back on her feet, but only if trade with the U. S. was resumed instantly. If not, "even the bare essentials of life for the Japanese cannot be produced." END

How to Fly IN WINTER

By G. SIDNEY STANTON

You will find that winter flying is real sport as long as you apply these safe and sane rules.

NOW that the winter season is here, perhaps you are wondering what to do with your airplane. Not so many years ago nearly every motorist would put his car away at the first sign of snow, jack up the wheels, drain the gas, oil, and water, and lock the garage until the winter weather was over. Many airplane owners are prone to follow this same procedure and forsake their planes at the first frost in the mistaken belief that pleasure flying is purely a warm weather activity.

But flying is fun in winter, too. Crisp winter air adds zest, and a cabin heater can take away any unpleasant chill. The engine seems to run much smoother in winter, the air is free from the rough, summer convection currents, and the weather is far more dependable.

Like all sports, however, winter flying requires that you know the rules of the game. Year after year aircraft accident records have shown a sharp increase in the late fall and early winter. Most of these result from failure on the part of pilots to take necessary precautions. It is possible that the increase in accidents incurred by private pilots may be even greater this year, not only because more planes will be in the air, but also because the new Civil Air Regulations do not require the student or private pilot to master the information about aircraft engines, principles of flight, weather conditions, and safety practices and procedures which were previously regarded as an essential part of the pilot's qualifications. Moreover, on account of the new ruling which permits any private pilot to give flight instruction, many student pilots will not have the careful supervision formerly provided by certificated flight instructors.

Consequently, if you intend to enjoy the thrills of winter flying in light airplanes, you want to be certain that you are thoroughly acquainted with the special cold-weather precautions which will assure your safety.

Your airplane needs very little special

(*Continued on page* 110)

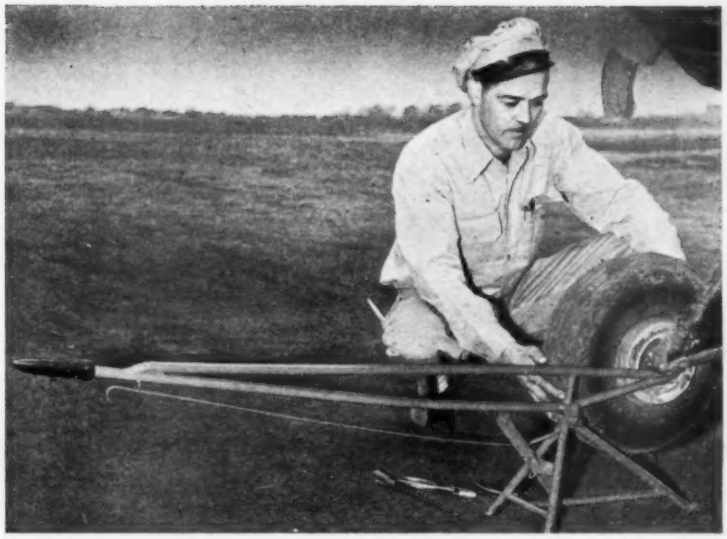
Have You Seen?

Experimental Culver "V" is undergoing CAA flight tests. It has tricycle gear, simplified controls, 85-h.p. fuel injection engine. Span is 29 ft., range over 720 miles. It is two-place, carries 35 gal. of fuel, has flaps. Wartime radio-controlled target was basis for "V."

Wrecked Navy Douglas transport plane lies on the airport at Winslow, Ariz., in full view of airline passengers arriving and leaving the field. The CAA has criticized airport operator and city government for leaving this derelict on display.

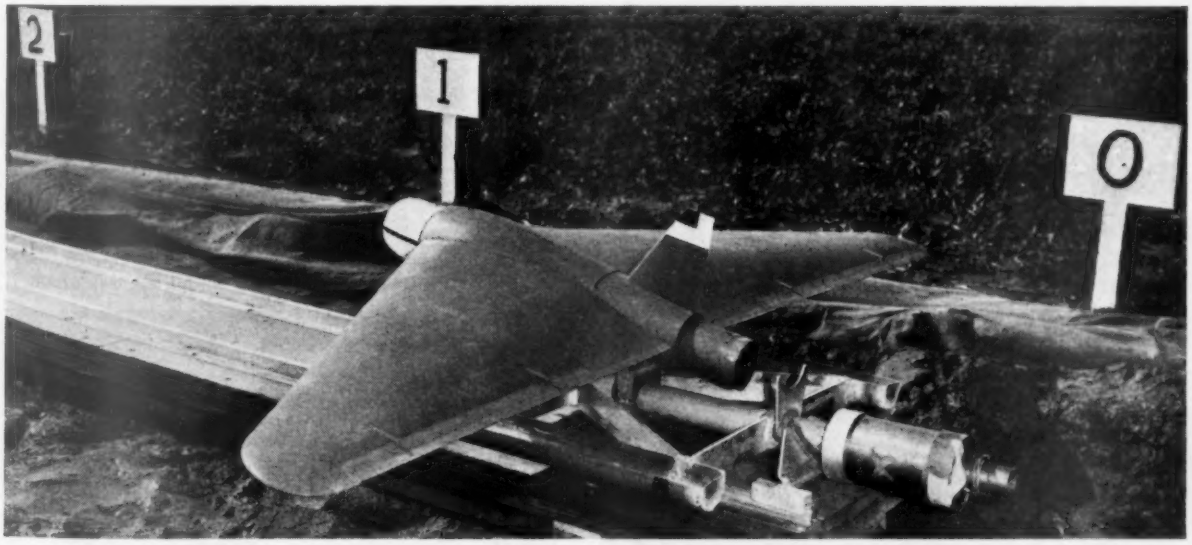
Navy Consolidated Privateers (P84Y-2) with giant loud speakers, once used to yell surrender messages to Japs, now are used for V-Bond sales.

No, he didn't crack up. This Hellcat headed in toward its carrier low, got a wave-off and staggered away unscratched. Note the sprinting LSO.



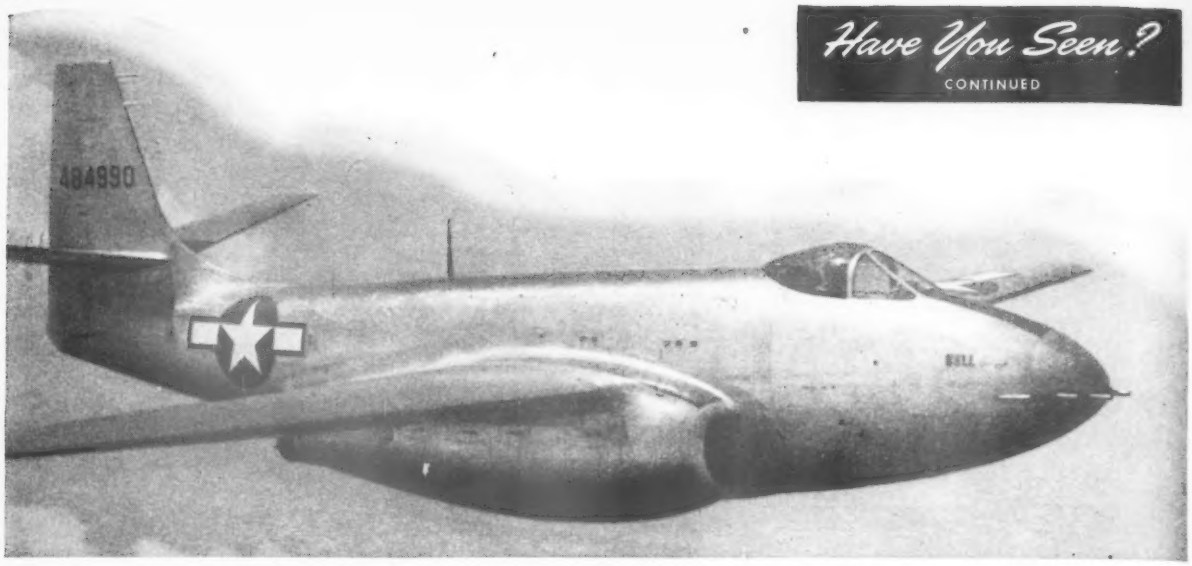
One-man jack for airplanes, developed by Consolidair Inc., Alliance, O., is made of welded aircraft tubing. Automatic ratchet locks jack in any desired position.

Piper Glomb (gliding bomb) was built experimentally for the Navy. It was made of fabric-covered plywood, carried a 4,000-pound bomb and could be towed by a Wildcat at 300 m.p.h. Radio and television remote controls were installed. Span was 33 ft.



Model of Northrop flying wing jet bomb is shown on special launching platform. Actual bombs are launched in 50 feet, have a range of over 100 miles at speeds of 350 to 400 m.p.h. They are powered with Ford-built jet engine based on that of German V-1. Span is 30 feet, weight about 7,000 pounds, and it carries 3,700 pounds of explosive. Project, now concluded, was AAF answer to German jet bomb.

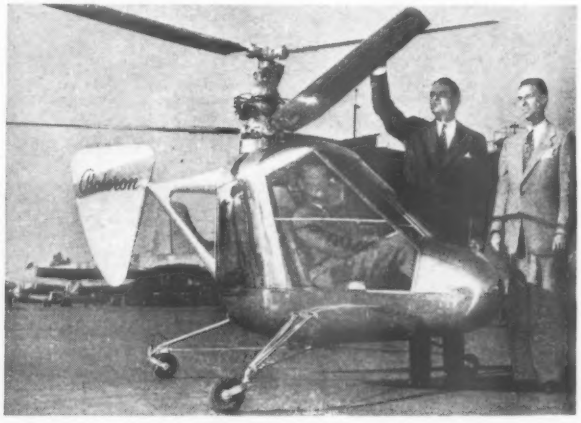
Have You Seen?
CONTINUED



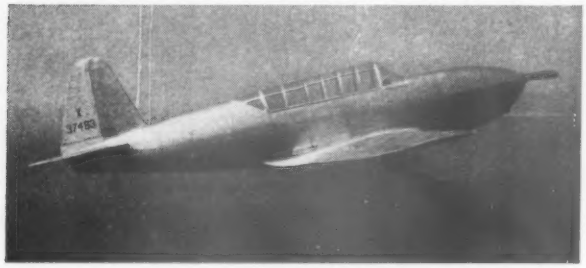
Top speed of Bell XP-83, long-range, twin jet-engined fighter is over 500 m.p.h. Gross weight, 27,000 pounds; wing span, 53 feet.

German Flettner Fl-282 helicopter had one 150-h.p. SH-14 engine, top speed of 100 m.p.h. Twin rotors turned in opposite directions.

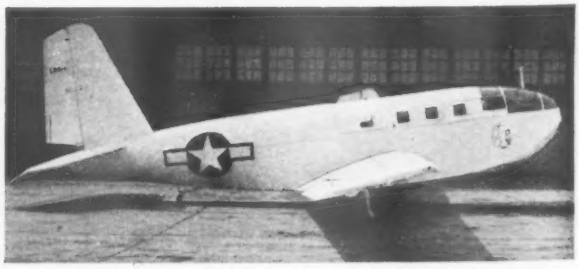
Novel aircraft propeller designed by a Glenview, Ill., engineering firm is metal ring with a series of fins, instead of usual blades.



Roteron single-seat helicopter has 25-h.p. engine between co-axial set of blades. Three-place version may sell for less than $2,000.



All-metal, two-place plane, PJC-4, built by Pasadena Junior College students, has retractable landing gear, cruises at 153 m.p.h.



Amphibious glider with 70-foot wing span, LRA-1 carries 10 persons plus two-man crew. Craft was tested by Navy at Philadelphia.

I Learned About Flying From That!—No. 75

By ROBERT SCHWARTZ

This pilot gave his new plane only a quick visual check before taking off. He ended up in the river.

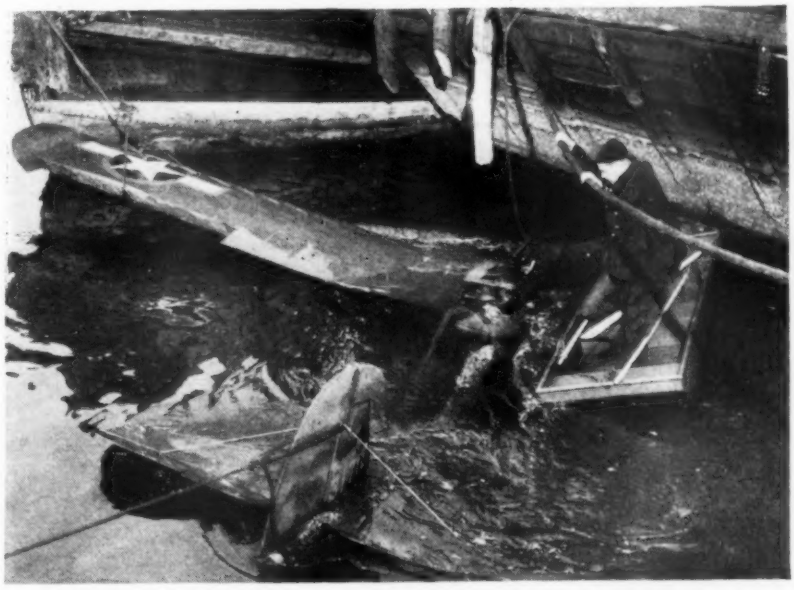
I HAVE held a pilot's license since 1923 and since that time have been flying around these United States at an average rate of a little less than 100 hours per year. I always understood and accepted the cost of owning and maintaining a personal airplane and never had cause to regret my avocation or its expense until November 28, 1944. On that day a two-hour flight cost me $1,038 or $519 per hour. Or to put it another way—I owned the airplane for about three hours, so the cost can be reduced to about $346 per hour. Regardless of how you figure it, my lesson was expensive.

On that day I made several mistakes. With all my so-called experience I should have known that what I was doing was incorrect but it must have been enthusiasm that caused me to overlook some basic and common-sense principles. And it taught me a lesson in how—and how not—to buy airplanes declared surplus by the Government. During 1939, 1940, and 1941, I was part owner of a Beechcraft 17. Having sold the plane in late 1941, I rented planes when I wanted to fly until 1944, when the urge to have my own plane again hit me. I heard of a Beechcraft that was offered for sale at the Albany, N. Y., airport. It was advertised in a DPC listing and from its description sounded like a good buy. I placed a bid of $1,775 for the airplane sight unseen and was making arrangements to go to that airport when I was notified that my bid had been accepted. Upon arriving at Albany I found that I was the high bidder. And why shouldn't I be? The airplane was being sold minus engine and propeller? That was the first lesson—never buy an airplane until you've seen it and have had it thoroughly inspected regardless of the sale source.

I finally sold my 10 per cent interest in this Beechcraft, and while walking around the field I saw a clean-looking Aeronca Army liaison plane that was for sale. I looked it over, saw that it had an engine and propeller, and was equipped with two-way radio (which practically sold me right then), new propeller, generator, battery, etc., and was reported to have had very little time on it although one forced landing was registered in the plane's log. It was open for bids, so I bid $1,038 for it, placed the required 10 per cent down payment, and returned to New York. Ten days later I was notified that Aeronca NC-31713 was mine—after I paid the 90 per cent balance. The following Saturday a friend flew me to Albany. Because of weather, we arrived at sundown, too late to do anything about getting the Aeronca ready that day. The next morning I was at the field, anxious to get through the formalities and fly my new plane back to my home field at Flushing Airport (see "Ports for the Private Pilot," FLYING's January issue). Since there were about 15 planes that had to be moved out of the hangar before mine could be reached, it was about one p.m. before the papers were all signed and I became the registered owner of the Aeronca. I was a real "eager beaver," and in my anxiety to get going, gave the plane only a fast visual check (another mistake), drained the purolator, gassed up, shot a couple of trial landings, and at about 1:55 p.m. cleared Albany for Flushing Airport on a contact flight plan.

There was plenty of snow on the ground and a little ground haze, but contact flight conditions were prevailing as I passed over Poughkeepsie. Just as I was approaching Nyack, I noticed that the r.p.m.s seemed to be dropping slightly. I thought that the throttle had vibrated back, so I advanced it until the r.p.m. indication was where it should be. After a while the tachometer again showed a drop. The ground temperature was 31° and the air temperature at my altitude (2,400 feet) was 38°, so I felt sure the carburetor couldn't be icing up. I cracked the throttle to see if that would correct the rapidly-dropping revolutions. It didn't. I changed my route, deciding that it would be better to follow the Hudson river than it would be to continue cross-country. The r.p.m.s were dropping steadily now and the needle was registering erratically between 900 and 1,100 r.p.m.s. The plane was now beginning to settle rapidly so I tried to find a spot to

(*Continued on page* 100)



Aeronca floats near dock after squad car rushed author to hospital. Harbor police hauled plane out within a half hour after the crash, but it was a complete wash-out.

THE LIBRARY

AVIATION FACTS AND FIGURES, 1945, edited by Rudolph Modley. Published by McGraw-Hill Book Company, 330 West 42nd St., New York, for the Aircraft Industries Association of America, Inc., in 1945. 173 pages.

The aviation industry has long been in need of a statistical compilation which could be used as a reference book by writers, editors, students and the industry itself. In this first annual book, Mr. Modley, who is director of the research and statistics service of the association, has presented a valuable and, within its scope, a fairly complete compilation.

Subjects covered include aircraft production, labor, finances, military aviation, airlines, personal flying, exports, surplus disposal and contract termination, service facilities, training, accidents, competing forms of transportation, research and development, public opinion and aviation, and foreign aviation data.

For the most part, the statistics come from conventional sources and there is no attempt to compile original material. However, the very advantage of such a book is that selected key facts from widely scattered sources are here gathered together into one convenient package. For a person who needs these facts, the present volume is invaluable. If a criticism can be made of it, it is that it is unattractive typographically, and carelessly planned with relation to the space and paper available. Careful planning could have made the book much more attractive with half the number of pages used. Better yet, the pictorialized statistics and charts with which Mr. Modley's name has long been synonymous, and which are wholly absent here, could have been used to make this document of really historical importance.

CURTIS FULLER

AVIATION, WHAT EVERYONE SHOULD KNOW, by Devon Francis. Published by Bobbs-Merrill, 468 Fourth Ave., New York, in 1945. 229 pages. Price $2.50.

This book gives a once-over-lightly to aviation and attempts to provide the casually-interested person a short-short course in everything from aerodynamics and the CAR to how to fly, meteorology, manufacturing and the future.

"Mr. Francis has the happy faculty of presenting technical matter in a non-technical manner, of simplification without oversimplification," says the blurb on the book jacket. Possibly, but parts of the book are hardly oversimplified enough—for instance, basic matters of aerodynamics which are not easy going to the uninitiated. For example, a statement like this: "In a high-wing plane the fuselage is pendular and lateral stability is inevitable," takes more than one reading, even from an aviation enthusiast.

If the publisher's idea is to live up to the book's title and really provide a short course in aviation, it is difficult to see just who the audience is. Certainly it is not the busy man feels that he has somehow not kept abreast of the fast-moving aviation scene and wants to brush up during a suburban train trip. For a person who is willing to mull over some of the pages, however, it is a great deal better. But Devon Francis, I am sure, would be the first to admit that aviation has become too vastly complex a subject ever to cover reasonably well in a flight of this duration.

JOHN C. ROSS

BIG DISTANCE, by Capt. Donald Hough and Capt. Elliott Arnold; published by Duell, Sloan & Pearce, Inc., 270 Madison Avenue, New York, in 1945. 255 pages. Price $3.

Here is an interesting account of the Fifth and 13th Air Forces' share in the South Pacific victory over the Japanese. The authors have captured the spirit of the total effort and have selected their illustrations of it in a manner that retains reader interest. They also find sufficient reason for eulogizing the courage and determination of the men who had no separate "tactical" and "strategic" air forces.

The saga begins with our retreat from Bataan and Corregidor and traces the long and costly air road back to Manila. Personalities, such as Gen. George C. Kenney, commanding general, Far East Air Forces, and his assistant, Lieut. Col. Paul ("Pappy") Gunn, and their active roles in the campaign are highlighted.

The book lacks photographs, but does supply maps that enable the reader to trace the progress made by our airmen as the story unfolds.

LAWRENCE KEIL

AIRCRAFT PRODUCTION DESIGN, by James E. Thompson; published by Aviation Press, San Carlos, California, in 1945. 242 pages. Price $5.

Essentially a reference book for the aeronautical draftsman and designer, this text represents a compilation of notes taken by the author for his personal use. Later, a University of California course on production design was based on it.

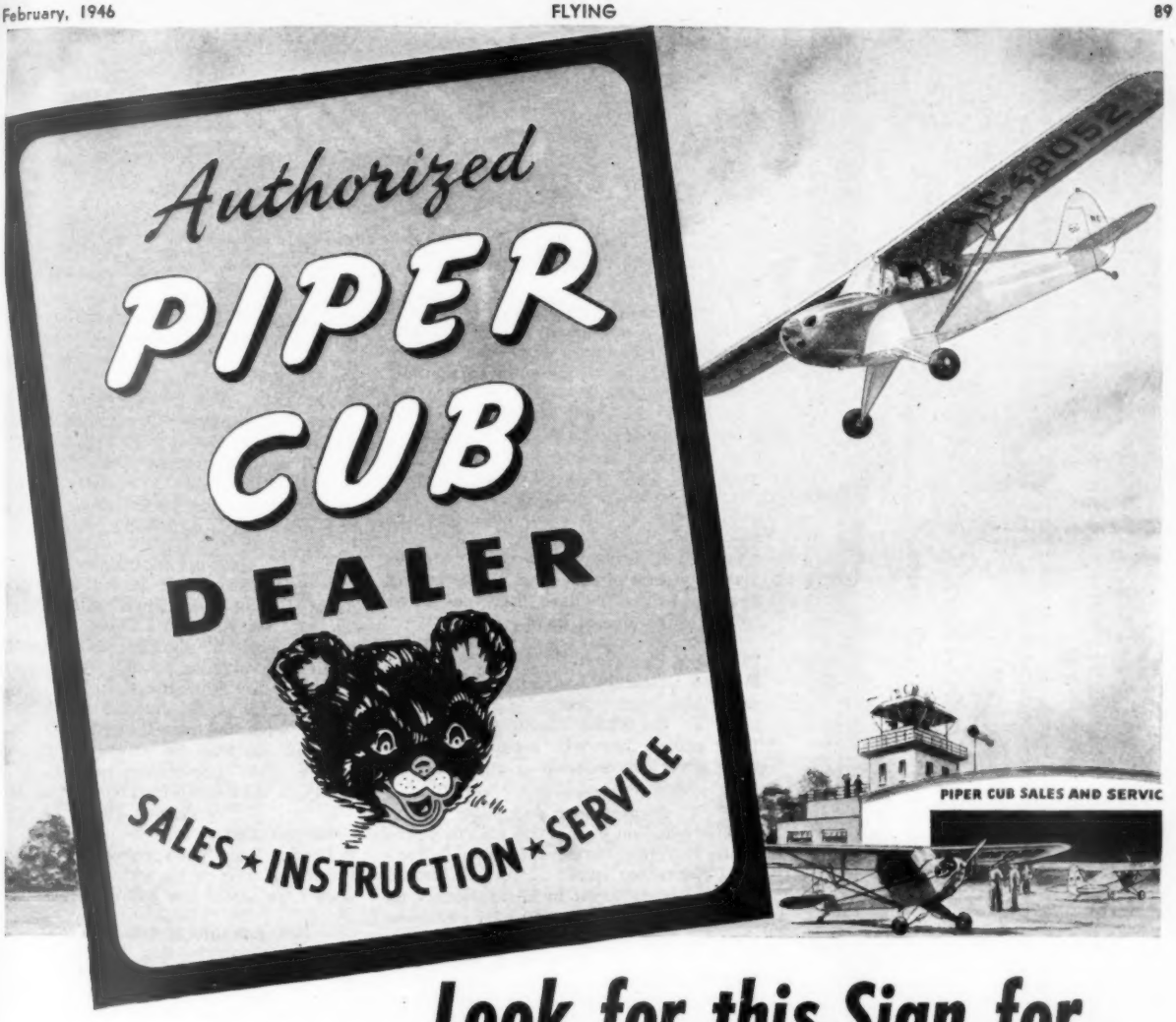
In its revised and amplified form, the book should be of considerable help to those who wish to obtain a better understanding of the tools and processes used to manufacture various designs, and who want such designs to embody good manufacturing practicability and economy.

Design factors are discussed in the first three chapters while the balance of the book deals with actual production problems. Here, the author goes into considerable detail on drilling, reaming, counterboring, threading, milling and broaching. Sand and permanent mold castings are covered as well as die and pressure mold castings, fusion welding, cutting, bending and drawing sheet metal parts. Included are some National Aircraft Standards and a comprehensive index.

WILLIAM V. HUMPHREY

FLYING

"Roger, wilco!"



Look for this Sign for GOOD, SAFE PLANES

This sign represents a reputation in aviation. It identifies a dependable dealer backed by a name that has meant leadership in the light plane field for over fifteen years.

Today, more than ever, you can depend on your Piper Cub Dealer for good, safe planes you can afford to buy and fly . . . planes with a time-honored reputation for quality and dependability.

When you want the most for your money in an airplane, in flying instruction and in service . . . look for the sign that says "Authorized Piper Cub Dealer."

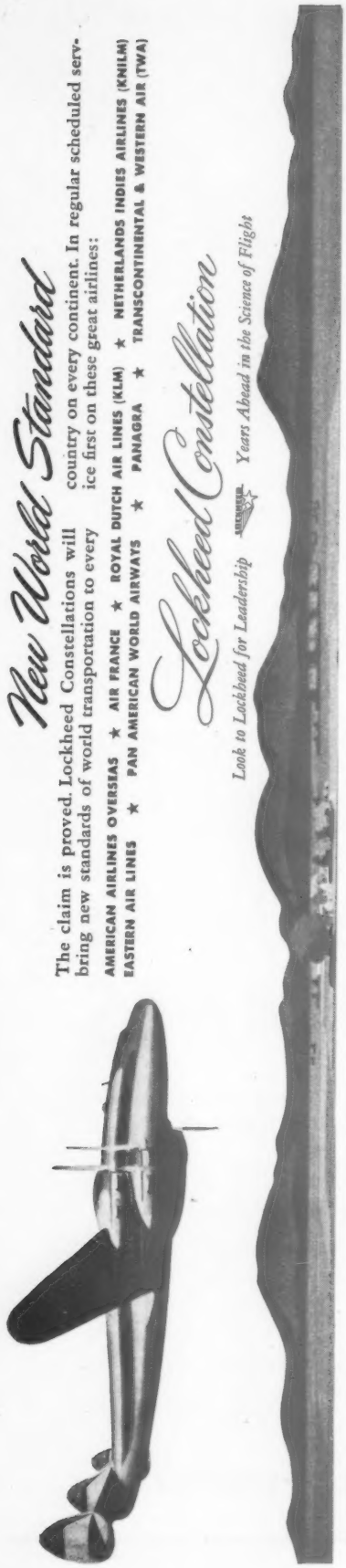
"HOW TO FLY" BOOKLET FOR YOU. Covers basic steps in flying with 53 photos and descriptions. Many other facts and full-color pictures of Piper Cubs. Ask your Piper Cub Dealer for your copy or write Dept. PA26, enclosing 10c in stamps or coin for postage-handling.

IS YOUR TOWN READY TO FLY? Free booklet, "What Your Town Needs for the Coming Air Age" will help your town plan an inexpensive landing area now! For your copy, write Dept. PA26W.

GREAT OPPORTUNITY FOR SERVICEMEN—Do you want to get into aviation when discharged? Let us tell you how you can capitalize on your experience. Write full information regarding yourself to Dept. PA26S.

PIPER AIRCRAFT CORPORATION ★ LOCK HAVEN, PENNSYLVANIA

In Canada—Cub Aircraft Ltd., Hamilton


New World Standard
The claim is proved. Lockheed Constellations will bring new standards of world transportation to every country on every continent. In regular scheduled service first on these great airlines:
AMERICAN AIRLINES OVERSEAS ★ AIR FRANCE ★ ROYAL DUTCH AIR LINES (KLM) ★ NETHERLANDS INDIES AIRLINES (KNILM)
EASTERN AIR LINES ★ PAN AMERICAN WORLD AIRWAYS ★ PANAGRA ★ TRANSCONTINENTAL & WESTERN AIR (TWA)
Lockheed Constellation
Look to Lockheed for Leadership
Years Ahead in the Science of Flight

Letters

Reader comments should be addressed to Letters Editor, FLYING, 185 N. Wabash Avenue, Chicago 1, Illinois. All letters should be signed. Names withheld upon request.

PLANE PRICE PROBLEM

Although a newcomer to aviation, I'm interested in buying a plane just as soon as I can learn the facts and figures on the various types of planes.

I note all lightplane manufacturers are reluctant to include the price of their product in advertisements. Are they ashamed of it? Advertising is the medium whereby a manufacturer lets the public know what his product offers and how much it will cost.

Over a month ago I wrote to all the manufacturers of the small planes asking data and prices. To date I have not heard from a single one of them.

G. GIANNOTTI

Pittsburg, Calif.

● Even automobile manufacturers were uncertain about prices until recently. As soon as lightplane builders determine their prices they will include them in their advertisements.—ED.

FAIRCHILD FUEL

Where do you put the 240 gallons of gas in the Fairchild *Forwarder* shown in FLYING's November issue? I, for one, would dislike having to sit in an airplane long enough for a Warner or Ranger engine to burn up that much gasoline.

M. K. HALVORSON

Kansas City, Mo.

● FLYING was fouled on the fuel figures. Gas capacity should have read "60 gallons."—ED.

CORRECTION

In "Have You Seen?" FLYING's December issue, the caption under the picture of the XP-82 states "the project has been dropped."

Actually the project is very much alive, and realizing your comment was an oversight we would appreciate a correction being published as soon as possible.

LIEUT. COL. ARTHUR F. SPAETH

ATSC, Wright Field, Dayton, O.

● FLYING's information, obviously erroneous, was in print prior to a general release on the XP-82 dated November 23. For more details see "Twin Mustang," FLYING, January, 1946.—ED.

RAPS NEW CAA RULES

Sirs:

The new CAA regulations permitting a private pilot to give instruction is going to disappoint many overseas veterans who plan on earning a post-war living instructing in flying.

Under the new set-up, an operator could fly students with private pilots as an instructor, get dual prices for this service, and still not pay the private pilot instructor, for the operator could sign the log books. This points to more accidents and a black eye for aviation.

A FLYING INSTRUCTOR

El Paso, Tex.

● The new rules provide that any instruction given by a private pilot *does not* lessen the amount of dual instruction required by a certificated instructor. We believe very few operators will be foolish or unscrupulous enough to adopt the practice mentioned above.—ED.

ENGINE TROUBLE

In your November issue "I Learned About Flying From That," Alex Papana tells of a test flight in a *Black Widow*. In part he says, "I immediately turned the cross-feed valve on so that both engines would be fed from the right tank. Just as I was going to shut off the left gas tank and *feather* the left engine . . ." Can you tell me why he would feather the engine after previously admitting his right gas tank could feed the left engine?

LIEUT. ROBERT E. PAGE

Frederick, Okla.

● Reader Page has a technical eye. Alex Papana advises us his article should have stated "restarted the left engine."—ED.

GETTING IT STRAIGHT

In "Decision in Air Policy," FLYING September, 1945, F. D. Walker stated: ". . . a new decision which granted United Air Lines a certificate to operate between San Francisco and Honolulu."

To date no certificate has been issued to UAL or any other applicant in the so-called "Hawaiian Case," now before the Civil Aeronautics Board, although United has been recommended for the route.

JAMES A. TOMLINSON
Attorney, CAB

Washington, D. C.

● FLYING's error was due to misinterpretation of a CAB press release.—ED.

STAMPS WANTED

Stamps for the Wounded, organized a year ago to aid servicemen stamp collectors in 25 hospitals, was so well-received we are now working in 74 hospitals.

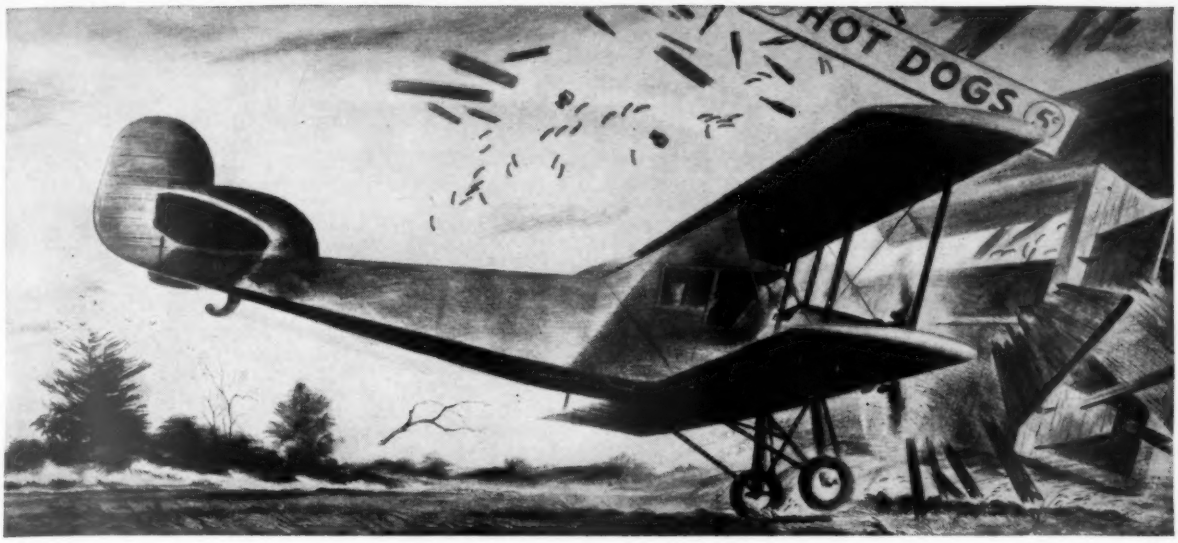
Unless we can get many thousands more of stamps we will not be able to carry on. During the first year volunteers provided us 4,000,000 stamps, but this year unless that number is doubled, many men in Army and Navy hospitals will be disappointed. That is, unless your readers will help us by sending in stamps.

ERNEST A. KEHR

New York, N. Y.

● Readers wishing to aid in this worthy cause may send stamps to Stamps for the Wounded, 230 West 41st Street, New York 18, N. Y.—ED.

END



The plane that flushed an idea from a hot-dog stand—

WITH all the improvements on today's planes, it seems strange to think that airplanes haven't always had parking brakes.

Back in the early days of flying, Eddie Stinson landed at a small field in Northern Michigan with a passenger.

Ready to take off, Eddie found that his starting battery had gone dead. So he told his passenger to open the throttle a little bit while he started the motor by pulling the propeller through.

The motor started with a roar! The passenger, confused, had pushed the throttle wide open. Eddie jumped clear as the plane roared down the field.

But dead ahead was a hot-dog stand that couldn't jump!

The plane tore into the stand. At 1650 r.p.m., the propeller churned mustard, pop, hot dogs, and buns into a froth. Only then did the passenger recover enough to cut off the ignition.

The hot-dog stand cost Eddie Stinson $350, plus a new propeller. But it showed him a way to make planes safer!

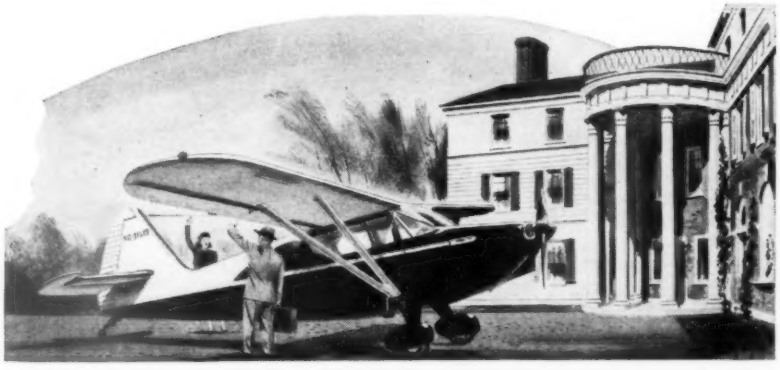
Two days later he had rigged up a parking brake to operate with brakes on landing wheels.

Years of flying showed Eddie Stinson what fliers needed and wanted in a plane. So the first Stinson he built, back in 1925, was a plane ahead of its day. Besides brakes, it had an enclosed cabin, an electric starter, and a cabin heater.

Because Stinson has always been a leader, you can depend on Stinson to bring you the best in quality planes.

• • •

Announcing THE STINSON VOYAGER 150... Here's a four-place ship that will bring you *speedy, safe,* and *comfortable* air travel.



And air-travel luxury such as you have never seen before, except with larger, more expensive planes!

The Voyager 150 cruises at 125 m.p.h., has a maximum speed of 133 m.p.h., and a range of 500 miles. Its power, maneuverability, and high-altitude performance make it a *versatile plane anywhere.*

And the appointments of the Voyager 150 match its performance. Its cabin is soundproofed and ventilated. You'll fly in comfort on its richly upholstered, adjustable seats.

And economically, too! For costs of operating the Voyager 150 will compare favorably with the cost of operating your car.

Write for a free illustrated brochure telling all about the Voyager 150 . . . to Stinson Division, Consolidated Vultee Aircraft Corporation, Wayne, Michigan.

Stinson

EASY TO BUY...EASY TO FLY

Stinson Division, Consolidated Vultee Aircraft Corporation, Wayne, Michigan

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA), with National Headquarters Office located in the International Bldg., 1319 F Street, Washington 4, D. C., is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special bulletin is sent each month to all registered AOPA pilots and also confidential newsletters from AOPA's Washington staff are sent members from time to time

NEW PLANE PROBLEMS

"Noise abatement" is a term which we shall hear more and more as time goes on. And the problem of silencing aircraft engines is a first on the noise abatement list. With an increasing volume of petitions for new airports being turned down by local zoning boards because of noise nuisance, it is high time that manufacturers of aircraft and of airplane engines were made to realize the necessity for immediate action leading to solution of this problem.

Research groups who have studied this problem agree that personal aircraft can be silenced sufficiently to remove this nuisance factor. Many who have worked actively on such projects insist that only the reluctance of manufacturers delays this vital step and that such reluctance is needless.

It is evident that airports must be located in or close to residential or business districts if the personal plane is ever to achieve any appreciable degree of utility. But "airparks" will never be so located advantageously (in any great number) until successful aircraft noise abatement programs are inaugurated. There are adequate statistics available to establish this fact.

The Bridgeport *Post* recently commented on the problem in an editorial entitled, "Noisy Planes a Nuisance." The title itself summarizes the problem, but its detailed exposition is worthy of consideration. We quote from this enlightening editorial:

"Small planes constantly going to and from any airport are an infernal nuisance to persons living within miles of the port. The attempt to depict them any other way is just dodging the issue.

"The truth of the matter is that the aviation industry has a responsibility in this airport business and until the industry is able to produce planes which are relatively silent (which means a proper muffling of their engines and proper pitching of their propellers) every airport will be a nuisance, a menace and a detriment to the neighborhood in which it is located. This is true whether the airport is public or private . . . those living in the vicinity, over whose houses the planes will be constantly passing, will know no peace from the day the airport opens for business.

"This observation applies generally to airports everywhere, commercial or non-commercial, public or private. The airplane itself is the basic nuisance. Not the hot dog stands, not the gasoline stations, not the motorists going and coming, but the thing which flies overhead, and thereby invades everybody's home, violates everybody's privacy, destroys everybody's quiet, and makes a blooming nuisance of itself.

"For any person seeking quiet in the country or elsewhere today the airplane is public enemy No. 1. Until we have quiet airplanes, local airports will continue to destroy, or at least depreciate property values."

AOPA hoped that John Geisse might provide some CAA support for the noise-abatement program we have long advocated. But it appears that CAA in general is going in the opposite direction. They recently acquired for use by their CAA inspectors, a fleet of surplus Army BT-13A's which are probably the noisiest airplanes ever built. When this was called to the attention of CAA, instructions were issued to field personnel to operate the aircraft as quietly as possible and to endeavor to reduce the noise factor. We suggest that the least CAA can do is to go to lower-horsepower aircraft which are also available under surplus allotments and in sufficient quantities. Beyond that CAA might well espouse the cause of complete noise abatement in air operations.

This problem is real and is serious. We predict that unless manufacturers act promptly, there will be put into effect strict local laws penalizing pilots who fly noisy aircraft in much the same manner as do automobile laws which enforce the use of mufflers. The principle is identical. Plane manufacturers could be alert enough to anticipate this likelihood of undesirable laws' being promulgated, save themselves much grief by simply putting into immediate use the research data already completed on noise abatement. They should actively foster further research in this direction.

While evasion of restricting laws is desirable from the standpoint of the industry as a whole, it should not be the sole motivating factor. Any expenditure for research that would result in dampening the engine noise as we know it today, would repay itself many times over in increased sales. Too, those manufacturers willing to aid in such development would create needed good will.

AIRCRAFT STANDARDS

The National Aircraft Standards Committee has recently reported to AOPA the nature and current extent of its studies on personal aircraft standardization. The studies are being conducted in an effort to reduce the initial cost of light aircraft and their cost of maintenance, and to increase their utility. NASC hopes to work out a program of collaboration between aircraft manufacturers in a concentrated aircraft standardization program. AOPA for months has stressed the need for this and is co-operating with the NASC in its endeavors.

Effectiveness of this program can be stimulated appreciably if AOPA members will continue to send specific recommendations concerning such improvements to AOPA headquarters.

Among the types of subjects currently under consideration by the NASC are the following:

1. Standardization of landing gears (wheels, brakes, tires, tubes and axles). It is believed that there are entirely too many tire sizes, axle diameters, etc.

2. Batteries and battery boxes. It has been decided that three classes of 12-volt batteries should be proposed—15 A.H., 25 A.H., 35 A.H. It is proposed that a plug should be developed for adoption in lieu of external terminals. Use of plastic cases is considered highly desirable in the standardization program. The CAA requirement for an extra battery box has met with considerable opposition since it is considered possible to produce an installation that is non-spilling in the unit's own non-cracking case.

3. Propellers. This is a project currently under consideration by the engine technical committee of the NASC and relates to a breakdown for propeller mountings as follows: (a) over 150 h.p. to use the SAE No. 20 spline; (b) 150 h.p. and below should have the flange type mounting, and should include separate bolt patterns for those aircraft below 65 h.p., 65 through 100 h.p., and over 100 through 150 h.p.

4. Instruments and arrangements. The Committee has decided that a standard means of indication such as top to bottom, left to right, and clockwise should be considered. Three general instrument arrangements are proposed: (a) Contact, (b) semi-blind flight, and (c) special blind flight. "Packaged units" are also being considered as a means of saving cost to owners.

5. Mufflers and manifolding. Preliminary conclusions are that the bolt and pad size on engine exhaust ports and exhaust equipment flanges should be standardized.

6. Radio. For standardization, 12-volt systems are being considered, together with a standard series of sizes for uniform mounting and installation.

Other preliminary conclusions cover location and mounting of position, landing and instrument lighting, standardization of safety belts, and standardization of spark-plug sizes. END

"Here I am as Promised—

SUPER WAR POWER FOR ALL PLANES!"

NEW Mobilgas AIRCRAFT

GIVES FLYING HORSEPOWER

Mobilgas AIRCRAFT

NOW—great new flight power for commercial *and private planes—Flying Horsepower*...from NEW Mobilgas Aircraft!

Flying Horsepower is the same super power that helped give U.S. military planes quicker take-offs... faster climb . . . greater range, load capacity.

It's the result of the world's greatest catalytic cracking program . . . climaxed by the famous TCC Process and Magic Bead catalyst.

Get NEW Mobilgas Aircraft—the sensational new aviation gasoline that gives *Flying Horsepower*—today!

SOCONY-VACUUM OIL CO., INC. 26 Broadway, New York 4, N. Y., and Affiliates: Magnolia Petroleum Company, General Petroleum Corporation of Calif.

TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.S.T.—NBC

Flying Huckster

(*Continued from page 42*)

findings and conclusions are based was obtained and compiled by executives and key employees of the various consignees, by representatives of the Ralph E. Myers company and by various other interested and distinterested agencies and individuals.

Summarized from the detailed report of the UFF&VA committee, here are the more general facts which the test established:

EQUIPMENT AND AIRPORT FACILITIES. Two of the three plane types employed, the DC-3, and the Model 39, cruising at speeds between 175 and 225 m.p.h., were able, traveling on established air lanes, to make delivery to all markets east of the Mississippi in between 14 and 19 hours. This elapsed time included two stops for refueling, each of which often consumed as much as one and one-half hours' time. Average flying altitude was between 9,000 and 13,000 feet, generally insufficient to maintain desired load temperatures of 36° to 42°. This, combined with the fact that refueling stops were characterized by excessive ground temperatures and that none of the equipment used was either insulated or refrigerated, made it difficult and in many instances impossible to maintain desired transit temperatures.

Cargo compartments of both the Model 39 and the DC-3 are cylindrical, that of the Budd *Conestoga* is rectangular in shape. Loading and balancing problems were intensified in the cylindrical types, especially the Model 39, in which the middle wing construction necessitates a break in the cargo compartment. Despite these handicaps, and with carefully precalculated data, loading of the Model 39 was usually concluded in about one hour. Loading of the DC-3 and the *Conestoga* took considerably less time.

While most of the 30 test shipments were completed on schedule, several were delayed by either mechanical failure of equipment or adverse weather conditions. Effect of these delays was aggravated by lack of refrigeration facilities for keeping ladings at proper temperatures during unexpected flight interruptions.

Except for air bases of the United States Army Air Forces which were used in many instances, airport facilities, including practically all commercial airports utilized, were found inadequate, especially for accommodation of the Convair Model 39. Runways were too short for safety in take-off and landing, runway surfaces were not properly stressed for heavy air freight loads, refueling facilities were inadequate for efficient servicing of four-engined planes, and most airports were comparatively inaccessible from the standpoint of quick delivery to receivers.

In all instances, commercial or municipal airports in all terminals reached were found to lack proper facilities for efficient handling of air freight on a commercial scale.

CARRIER PERFORMANCE. With a few notable exceptions, the experiment unearthed little evidence that executive management of established carriers believes in any substantial future for airborne perishables. Only a few were willing to probe seriously into that future.

Aside from a general lack of co-operation, operational performance was qualified by regulatory and operational handicaps. Earlier in the test period, many shipments were carried by United Air Lines, which follows the "northern" or "great circle" route. Weather conditions often made flights impractical, causing last minute cancellations of shipments or grounding at points where emergency distribution of lading was impossible. Had it been possible to re-route these shipments over the "central" or "southern" routes, controlled by competing airlines, delay and loss in many instances could have been avoided. But Government air regulations made that impossible.

All Model 39 shipments, flown by American Airlines over the southern route, benefited from "eminently satisfactory weather." But that route necessitated flying from 150 to 750 miles farther than the direct or great circle route. For example, actual distance flown to Cleveland was 2,625 miles against 2,200 via the great circle route, Detroit 2,565 against 2,300, New York 3,022 against 2,500. The additional cost per load was in some instances nearly $500.

Broadly speaking, operational skill and experience to be found generally in the aeronautical industry is adequate to handle any volume of perishable shipments it might be found profitable to ship by air. But continued application of rules and regulations granting exclusive rights and privileges to scheduled carriers over specific routes or air lanes acts as a serious bar to air shipments of perishables generally. Conversely, non-scheduled operations appear to provide the flexibility necessary for satisfactory movement of perishables.

COSTS AND RATES. The lowest published tariff on airborne shipments, 26 cents per ton-mile, was the maximum transportation charge made on any given commodity during the test period. But it became apparent that airborne merchandise will not be shipped in more than meager volume at rates based on that figure.

Obviously, the 26 cents per ton-mile charge for airborne freight (compared with two cents for rail transportation) does not encourage mass air shipment of low-cost freight. But the fact that Myers has driven the original 84 cents per ton-mile cost of a few months ago down to this new low does give promise that he will succeed eventually in cutting the ton-mile levy to 10 cents. This cost level, Myers believes, will be acceptable by the buying public for the superior products it will deliver.

A very important factor in flying perishable food to profitable markets is the availability of profitable return payloads. Obviously, flying huge planes back empty would impose an unbearable expense upon the fresh-food cargoes. Already, however, returning planes have carried payloads of stoves, jeeps, radios and washing machines. One cargo consisted of big, thick eastern mushrooms which were sold at $1.50 a pound, compared with the price of $1.75 at which small, button-type western mushrooms were being sold. The general feeling as to the availability of high-priced items for shipment from the manufacturing east to the agricultural west is optimistic. The prospect for balancing south-to-north food shipments with north-to-south airborne freight is not so good.

Packaging costs were high. Wartime

(*Continued on page 98*)

FLYING

"Now do you believe their ad about post-war service?"

the Scene is any large airline terminal. The aircraft are the new Douglas DC-6 and the Lockheed Constellation "49"—bringing to the commercial airlines new standards in passenger comfort—featuring the Curtiss Automatic Synchronizer for quieter, simplified engine control and Curtiss Aerodynamic Braking by reverse thrust for shorter, smoother landings.

CURTISS ELECTRIC PROPELLERS

A Division of Curtiss-Wright Corporation

FIRST

AERONCA—America's Oldest Light-Plane Manufacturer

It's a "Standout" in Performance and Ease of Handling—Will Outfly Any Plane in Its Class! New Beauty! More Room! Greater Visibility! 35 Thrilling Features *Never Before Offered in the Lowest Price Field!*

YOU'VE heard and read a lot about post-war planes . . . many glowing promises that may never pass the "blue-print stage."

But Aeronca—the *first* and *oldest* light-plane manufacturer in America—is already in production with a thrillingly advanced post-war model—The Aeronca CHAMPION! Next month—The Aeronca CHIEF (Side-by-Side model) will be off the line.

New Flying Thrill Awaits You!

In the new Aeronca CHAMPION, you'll find the kind of performance you've dreamed about! The newest in aerodynamic design! New gliding, landing and stall characteristics! It's the easiest plane you've ever flown . . . with far greater maneuverability . . . and greatly broadened range of visibility. A safety feature, particularly important in training and airport operations . . . extremely essential when making steep banks, vertical turns, and when taxiing in training areas as well as congested airports. Aeronca's amazing increase in visibility has been acclaimed by pilots and instructors everywhere as today's most important contribution to safety.

Just wait till you see Aeronca's luxuriously finished interior . . . the extra room and comfort . . . the wide safety-swing doors . . . big luggage compartment—things you never expected in a low-cost plane.

You get Oleo landing gear as standard equipment. Improved brake system and tie-down rings that are built in. Parts for Champion and Chief will be 80% interchangeable—an important economy feature. Aeronca brings you 35 thrilling "standout" features—never before offered in the lowest price field.

Sensational Acceptance

Everywhere they've been shown, the new 1946 Aeronca CHAMPION has won sensational acceptance. Before you buy any plane be sure to see Aeronca—fly it—price it—compare it! You won't find another plane anywhere near the price that will give you the pleasure, comfort and low-cost, trouble-free flying that you'll get from the completely new Aeronca CHAMPION. See your Aeronca dealer for further details.

EXPORT AGENCY—AVIQUIPO, INC., 25 BEAVER STREET, NEW YORK 4, N. Y.

AGAIN!

—Brings You the Only Completely New Personal Plane

Aeronca Champion!

A two-seat tandem type airplane. Large, roomy cabin. Streamlined safety-step and an automobile-type door afford ready access to both seats. Unusually fine visibility. Thrilling performance. Improved positive action tab control makes "hands off" flying practical. Easiest-flying, easiest-handling, most comfortable plane ever offered in lowest price field.

AERONCA

AMERICA'S NO. 1 PERSONAL PLANE

AERONCA AIRCRAFT CORPORATION, MIDDLETOWN, OHIO

(*Continued from page 94*)

conditions often forced the use of substitute materials which were higher priced but less satisfactory. Most of the packaging operations, and even the manufacture of the containers themselves, were performed by hand. This work could have been done mechanically at far less cost had time and equipment been available.

It is significant, however, that it was possible to pre-package, in a reasonably satisfactory manner, nearly 300,000 pounds of fresh fruits and vegetables, even though handicapped by lack of time and facilities and with comparatively little precedent or prior research upon which to lean. Costs, employing methods and equipment now available, can be reduced or at least held to a competitive basis. In other words, it does not seem likely that the extra cost of pre-packaging could in any instance be sufficiently high to become the determining factor in deciding whether any commodity can be profitably shipped by air.

Actually the pressure to wipe out all needless weight in the relatively high-cost-per-pound of air shipments has created many economies in crating. Substitution of a wire lettuce crate for the conventional nailed crate, for instance, cut the weight from nine and one-half pounds to four pounds. This one improvement cut air-freight costs $1.50 a crate. The disparity of the average payload of present cargo planes of nine to 10 tons compared with the 40-ton capacity of the average refrigerator car was less discouraging to shippers on realization that the heavy ice requirement of the boxcars sometimes ends in a net of 11 tons of waste cargo.

PRE-COOLING. Prior to the launching of this project, the idea had been advanced that one of the principal advantages of shipping perishables by air would be the elimination of pre-cooling and refrigeration services and costs. The experiments indicated that this conception was wholly in error.

Initial shipments showed that pre-cooling of ladings was positively necessary. Temperatures at flying altitudes provided little or no assistance in keeping perishables at desired temperatures. Consequently, all shipments, after the first few, were pre-cooled before loading. Three types of pre-cooling were employed; (a) block ice—fan type, (b) dry ice, and (c) mechanical. Findings indicate that all vegetables should be humidified during pre-cooling. Some fruits require dry pre-cooling, others should be hydrated during the process.

It is important to note here, however, that the tests showed that dehydration in transit, a serious problem in the rail shipment of some commodities, can be entirely eliminated in air shipment. Airborne merchandise from California, for instance, can be delivered ounce for ounce at destination points anywhere in the United States.

RECEIVING AND MARKET DISTRIBUTION. Of the 12 initial receivers, five are established receiver-jobbers, four are companies operating groups of local retail outlets, and three are national chains. To these firms were added many other wholesale jobber, local chain and individual retail operations which, while they did not act as initial receivers, actively participated in the project.

Findings indicate that airborne produce can be handled efficiently and profitably by all established categories of the produce industry, to a degree—in the case of the individual operator—determined largely by the efficiency and success with which he is now handling fresh fruits and vegetables received by other forms of transportation.

ARRIVAL CONDITION. Aside from a few isolated shipments, no previous attempts had been made to transport perishables in commercial lots by air. Consequently, no prior index to proper maturity of produce was available.

With a few exceptions, therefore, each case of disappointing arrival condition resulted from lack of knowledge of what stage of maturity at which specific commodities should be harvested for air shipment. These exceptions involved (a) weather conditions which prevented delivery on schedule, (b) mechanical failures and (c) lack of distributive facilities—due to the experimental nature of the effort—which prevented quick and favorable disposal of ladings elsewhere than at their original destination.

Initial difficulties were encountered with commodities such as plums, peaches, apricots, grapes, cantaloupes, strawberries, and lettuce, but once the correct maturity indexes and packaging techniques were determined, these particular items were found especially adaptable to air transport.

Comparison with rail- and truck-borne perishables was inevitable. On the qualified basis of those specific commodities which were shipped during these experiments, airborne commodities at destination (article for article) were far superior to those shipped via rail or truck.

Fruits and vegetables matured naturally on trees and vines have a number of important qualities making them more desirable than those which are picked green and allowed to "ripen" on a two-weeks-long railroad or truck haul. Their sugar and vitamin content is higher. (Scientific tests have proved that airborne tomatoes contain 25.45 milligrams of vitimin C per 100 grams of sample as compared with 14.43 and 13.18 milligrams respectively for surface-borne and hothouse tomatoes.) Lush juiciness of airborne fruits, vegetables and berries is greater. Richer coloring and greater flesh firmness improve their appeal to the eye.

It is true that not every article shipped during the test period arrived in this condition, due principally to inexperience and lack of organization. For example, in the preparation of the first substantial quantity of honeydew melons ever shipped by plane, error was made on the side of under-maturity and the melons arrived too green for immediate consumption and did not represent airborne possibilities. Quality was perfect, but these honeydews were no more desirable than railborne melons.

In the case of cantaloupes, the experimenters were better prepared. Regular shipments of this commodity were made and repeated at the request of receivers and consumers. They found airborne cantaloupes so far superior in condition, eye appeal and flavor to those available by rail that the airborne product was almost literally regarded an entirely new melon. In the latter stages of the project, San Joaquin Valley cantaloupes for plane shipment to Philadelphia were actually picked in a more vine-ripened, fully-matured condition than those picked for shipment to San Francisco, less than 200 miles away.

CONSUMER ACCEPTANCE. Reaction of the ultimate purchaser to these airborne offerings, on the basis of appearance and quality, was universally favorable. This reaction was even more favorable after the housewife had taken her purchases home and she and her family had tasted

15 YEARS AGO

FROM the February, 1931, issue of this magazine:

Forerunner of push-button warfare (see page 38) was the photo-electric-eye camera invented by Klaman Tihani. Installed in the nose of a plane, the free-moving camera automatically sighted other aircraft. Motors geared to camera operated plane's controls so it would follow, crash and destroy the target plane.

"World's most powerful radial engine," the Armstrong Siddeley *Leopard*, was in production in England. Designed for heavy bombers, it had 14 cylinders, developed 800 h.p.

First airline stewardesses were assigned the Chicago-San Francisco run by Boeing Air Transport. Ten young women were employed to test the plan.

The Aircraft Engineering Co. announced its new plane, the ACE 200, a two-place high-wing monoplane with a Salmson AD-9 engine. Plane had 86-m.p.h. top speed, landed at 25 m.p.h. Cost: $1,555.

An invention to aid pilots flying in fog to determine correct altitude was announced in Holland. Device was a transmitter sending a radio wave which bounced back to the plane.

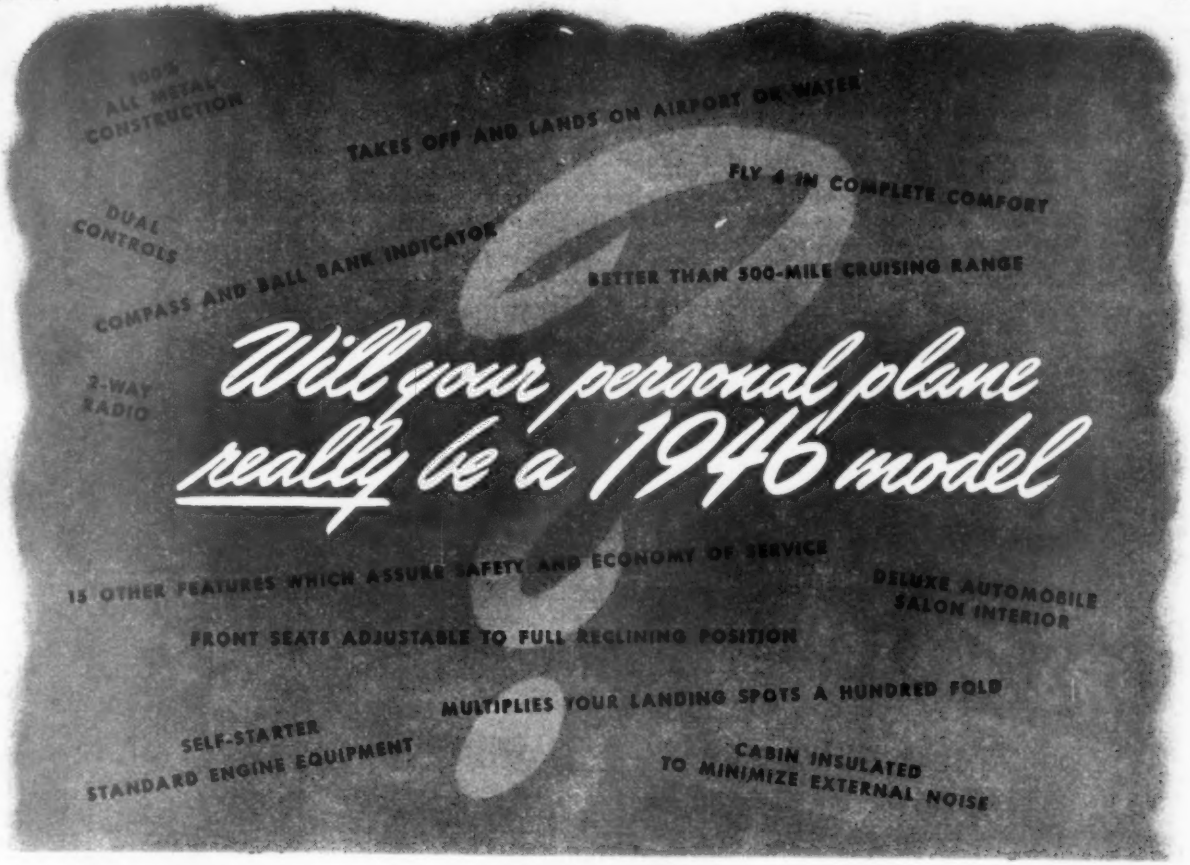
Newest military observation plane, the Curtiss XO-1G, was delivered to the Army Air Corps. Powered with a Curtiss D-12 engine, plane had 147-m.p.h. top speed.

The French Bleriot 111 monoplane with a 650-h.p. Hispano-Suiza engine set a new endurance record of 67 hr. 53 min. without refueling.

Government statistics on flying operations for the first six months of 1930 were: 12,887,532 gallons of gas, 537,212 gallons of oil consumed in both scheduled and non-scheduled flying. Total miles flown, 68,669,928.

First rocket airport in world was at Tegeler Way, near Berlin, Germany. Field was used exclusively for tests, one of which set rocket altitude record of 28,666 feet.

The German Junkers G-38, "largest land plane in the world," replaced its four gasoline engines totalling 2,400 h.p., with Diesel engines. Greater operation economy was given as reason for change.


100% ALL METAL CONSTRUCTION
TAKES OFF AND LANDS ON AIRPORT OR WATER
FLY 4 IN COMPLETE COMFORT
DUAL CONTROLS
COMPASS AND BALL BANK INDICATOR
BETTER THAN 500-MILE CRUISING RANGE
2-WAY RADIO
Will your personal plane really be a 1946 model
15 OTHER FEATURES WHICH ASSURE SAFETY AND ECONOMY OF SERVICE
DELUXE AUTOMOBILE SALON INTERIOR
FRONT SEATS ADJUSTABLE TO FULL RECLINING POSITION
MULTIPLIES YOUR LANDING SPOTS A HUNDRED FOLD
SELF-STARTER STANDARD ENGINE EQUIPMENT
CABIN INSULATED TO MINIMIZE EXTERNAL NOISE

Discriminating buyers will instantly recognize the Seabee 4-place all-metal Amphibian with its revolutionary engineering, as solely a product of progress . . . ¶ Conceived to measure up to the rapidly advancing needs of the postwar personal plane owner . . . it will be ready for delivery early in 1946 . . . ¶ Designed by the same engineering talent which developed the famous Thunderbolt, the Seabee is built to exacting standards that emphasize the inherent rugged qualities which characterize all Republic-built products . . . ¶ The broad experience in building aircraft to war's vital needs above all else qualifies Republic to build a comparable product for peace-time use . . . and at a truly modest price . . . . $3995. Flyaway Factory.

☆ ☆ ☆

There's a Blue Ribbon Seabee dealer near you, who'll be glad to give specifications. For further information address Personal Plane Division, Republic Aviation Corp., Farmingdale, L. I., N. Y.

Seabee

A PRODUCT OF **REPUBLIC AVIATION**

Makers of the Mighty Thunderbolt

ESTABLISH YOUR DELIVERY PRIORITY NOW

—the Seabee is well worth waiting for!

and eaten them. This latter fact is supported by hundreds of testimonials.

Particularly favorable was housewife acceptance of strawberries, plums and peaches. Tomatoes (packed in one-pound, consumer containers and offered hard-ripe) were an exceptionally popular item.

Consumer reaction, as to price, was varied. It can be reported that housewives—not, however, without a show of sales resistance—paid 44½ cents per pound for airborne grapes, against a community ceiling of 27 cents; 59 cents per pint for strawberries when community price was 29 cents; 29 cents per pound for cantaloupes, against a community ceiling of 9½ cents, and similarly high prices throughout the entire list of commodities.

The test supplied adequate basis for the conclusion that when the consumer is given the opportunity to obtain such merchandise in daily purchases, he will willingly pay any premium commensurate with the superiority in appearance, quality, condition and flavor that becomes so obvious after one or two purchases.

It should be repeated that much factual data which, in the scientific sense, might have strengthened this summarization has been purposely omitted. Deliberate deletion was effected in the effort to reach, in as direct and practical manner as possible and with as little qualification as the facts permit, a simple answer to this one question: Is it feasible and economically possible to ship fresh fruits and vegetables in commercial quantities by air transport? The Myers answer is "Yes." END

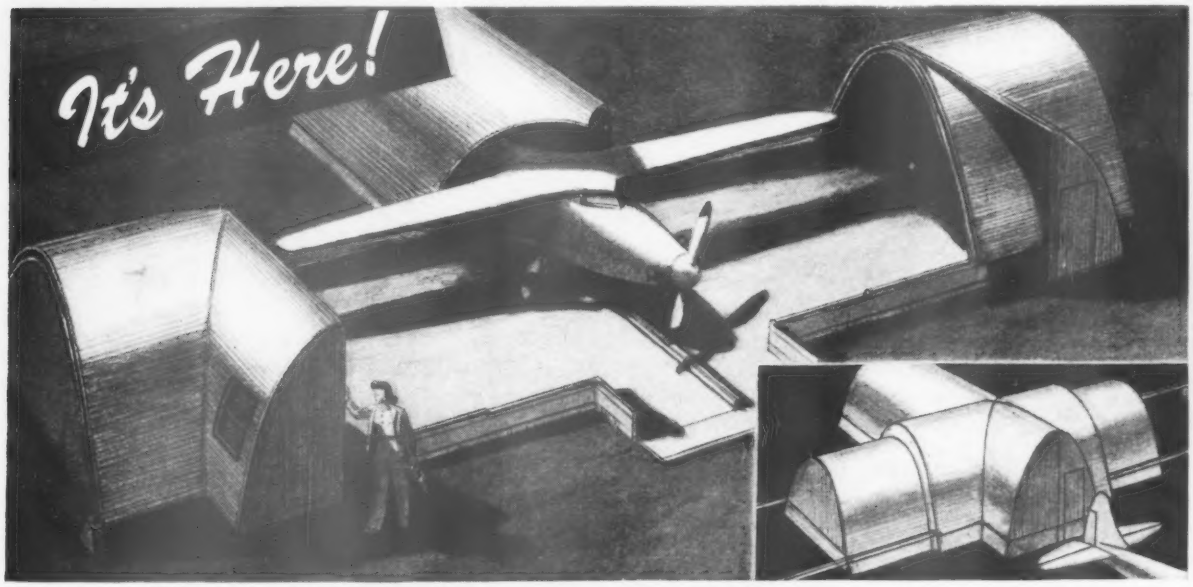
I Learned About Flying From That!—No. 75

(*Continued from page 87*)

land, but the snow-covered ground made it extremely difficult to select a suitable area.

At 900 feet altitude, I spotted a football field in upper New York City and turned west to try for a landing there. I still couldn't figure out what was wrong with the engine. I had plenty of fuel but the engine just wasn't getting enough of it. By working the primer, I was able to inject slight spurts of power but they helped very little. I approached the football field and noticed that a group of small boys were playing on it. When they saw the low-flying airplane (275 feet) they stopped playing and, to my dismay, jumped around the field shouting and waving at me. I realized that I couldn't risk a landing and the almost certainty of injuring those children so I tried to stretch my glide to the Harlem River.

It was maddening. I could see my home field but knew I couldn't make it. My altitude was decreasing all the time. I cleared the roof of an apartment house by only about 20 feet. The river was



Introducing the Revolutionary

New SILVER T HANGAR

As finely engineered and constructed as the plane it houses.

Enhance the value of your airport by using these new, aerodynamically-designed hangars. Investigate the Silver T Hangar features before you make a hangar decision.

All Aluminum for sturdy durability; *Distinctive* in appearance; *Finger-Touch Control* for easy operation; *Precision Engineered* for maximum utility and economy...Write for literature describing other revolutionary features.

An ultra-modern picture of airport service and facilities.

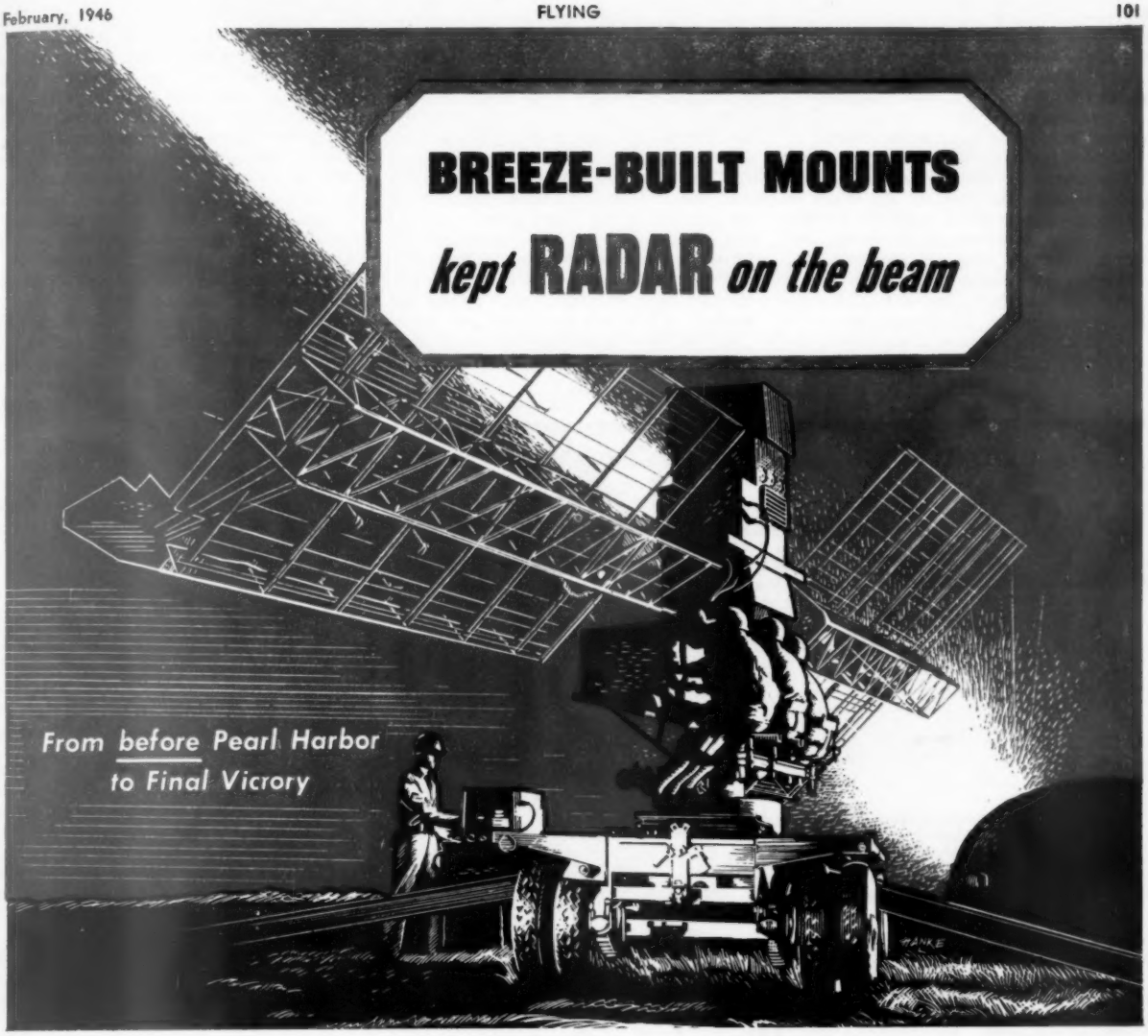
THERE'S NO OTHER LIKE IT!

Get in on the ground floor *now* with our exceptional distributorship offer. Send for complete details *today*.

AIRPORT FACILITIES CORPORATION

Patents Pending

160 N. La Salle Street, Chicago, Ill.



Now, for the first time, it can be told . . . the story of how Breeze built mechanical precision into electronic vision for the U.S. Signal Corps . . . to keep radar accurately beamed . . . to put guns on target . . . and to blast enemy aircraft out of the skies.

Pioneered in the late 1930's, the Breeze Mobile Antenna Mount for anti-aircraft radar was in the war from before the start to the finish. It was a Breeze-Mounted radar set that detected the Japanese sneak attack on Pearl Harbor on December 7, 1941. Rushed to England in the worst days of the war, Breeze-Mounted radar first helped to keep Hitler out of London; later reduced buzz-bomb effectiveness by 75 per cent.

Before Victory was won, thousands of Breeze-built Mounts were produced and delivered — in time and on time to every theatre of war. This production record, backed by product performance, offers further convincing evidence of the wide range of Breeze "know-how". Listed below are other Breeze products which have made the Breeze Mark the mark of dependability the world over. The diversified skills and facilities which enabled Breeze to build these precision items in huge quantities for war are now available to other manufacturers for peacetime production. Perhaps Breeze can solve that complex production problem for you. For a complete analysis and recommendation, call in a Breeze Engineer.

BREEZE

NEWARK 7, BREEZE MARK NEW JERSEY

CORPORATIONS, INC.

BREEZE PRODUCTS AND SERVICES: Radio Ignition Shielding for Radio Noise Suppression • Flexible Shielding Conduit and Fittings • Multiple Electrical Connectors • Aircraft Tab Control Systems • Internal Tie Rods • Flexible Shaft and Case Assemblies • Cartridge Engine Starters (Manufactured under Coffman patents) • Flexible Metal Tubing • Heat Treating • Metals Fabrication • Armor Plate • Bookstacks.

only 50 feet wide at the point I was heading for so I had no choice as to the direction in which I could land. I held the plane off as long as I could, approached the surface of the river trying to land slower than I had ever done before.

Suddenly there was a tremendous splash and I was under the water. The plane sank to the level of the wings in about seven seconds. I broke the window and door, crawled out of the plane, and climbed on the wing. Fortunately, the tide carried the plane to the shore, where I stepped off onto a dock—wet, cold, shivering and dazed by my experience.

In about five minutes, a squad car arrived and whizzed me off to a hospital. About a half hour after the ditching the harbor police arrived and pulled the dripping Aeronca from the river—forever consigning it to the scrap heap.

Subsequent examination by a CAA inspector revealed that engine failure causing the emergency landing and resultant crack-up was due to defective flexible fuel lines. These fuel lines had been on the airplane when it was Army property and probably were the cause of the forced landing on the plane's log. The log stated that the landing gear and wing tip had been damaged and "reason unknown" as the explanation of the crash. The plane had logged only one hour since that time and was on the ground for the three weeks prior to my ill-fated take-off.

Tests showed that the gas lines would swell as the fuel flowed through them, eventually reaching the point where no fuel could reach the carburetor. While the plane was on the ground and the engine not running, the lines would dry out and shrink again, permitting fuel to pass through them. If it had been permissible to run the engine up and test it thoroughly before purchasing, the defect would, in all probability, have been discovered. The Aeronca Aircraft Corporation issued a bulletin dated March 15, 1945, which stated in part: "The defective fuel hoses were manufactured during the period from May, 1941, to August, 1942, and it is possible that any such plane produced since May, 1941, may be equipped with *fuel hose of this type.*"

This lesson taught me to have any airplane I might buy in the future given an exhaustive examination by a licensed A&E mechanic, and to have a thorough flight test made before any papers are signed. END

It's NEW!

THE POST-WAR MODEL YOU'VE WAITED FOR

SKYRAD

LONG-DISTANCE AIRCRAFT RADIO RECEIVER DESIGNED AND BUILT BY PILOT-ENGINEERS

Model BL-5
SKYRAD Aircraft Receiver

Now you can have a feather-weight, inexpensive, long-distance radio in your private plane that gives you all the advantages and many of the features formerly found only in heavy, expensive aircraft receivers. The SKYRAD BL-5 was designed by pilot-engineers and built by a firm with 25 years' experience in radio manufacturing plus wartime production of complex Army and Navy radio and radar instruments. Its super-sensitive superheterodyne circuit provides sharp, distinct reception for radio-beacon flying, weather reports, control tower instructions. Compact—can be mounted in regular 3" instrument opening on dash. Over all size 4⅛" x 4⅛" x 4⅞" deep. Efficient—uses latest type low-drain tubes. Check these SKYRAD PLUS features:

Weighs only 2¼ lbs.—Covers 200 to 400 K.C. Band—Range Filter that permits selection of voice or range signals at snap of switch—Easy to install—Automatic Volume Control . . . No "Blasting"—Tower Switch—Airliner Performance—Shock-mounted Chassis.

Model BP-5
PORTABLE Aircraft Receiver

Take it with you wherever you go. Keeps you informed on weather reports, throughout your trip—in the air, in your car, in your home or hotel. Covers 200-400 K.C. band. Built-in loop antenna. Complete with batteries in shielded case. Headphones fit inside case.

MODEL-BL-5
$59.50
LESS BATTERIES

EASY PAY PLAN

Pay as you fly! No need to have all cash. Take advantage of the SKYRAD Easy Pay Plan. Place your order NOW!

LOOP DIRECTION FINDER

Once you fly with the SKYRAD Loop Direction Finder you'll never be without it. No need to follow the beam on cross country trips . . . it's easy to "home" with a SKYRAD Loop. Chrome plated . . . electrostatically shielded for reducing rain static . . . 10" diameter . . . weighs less than 2 lbs. . . . plugs into BL-5 receiver. Complete with azimuth dial, knob and pointer—

Only $29.50

DEALERS
DISTRIBUTORS
AIRPORT OPERATORS

There are still some desirable territories available for agressive dealers and distributors. Here is an unlimited opportunity to sell the air-minded millions who now own and will soon own their own planes. Write or wire for complete details of our liberal Plan for SKYRAD Aircraft Receivers and Accessories. DO IT TODAY!

SKYRAD

MAIL THIS COUPON TODAY!

GENERAL AIR INDUSTRIES
Dept. 10, 626 Broadway
Cincinnati, 2, Ohio
Gentlemen:
☐ Send illustrated folder describing SKYRAD Aircraft Receivers and Accessories and nearest dealer's name.
☐ Send Dealer Proposition if available in my territory.

Name _____
Address _____
City _____ State _____

GENERAL AIR INDUSTRIES

Exclusive National Sales Agents 626 Broadway, Cincinnati 2, Ohio

Fog

(*Continued from page 45*)

drops below this point, some of the invisible water vapor must be condensed out in the form of visible water droplets as the colder air can no longer retain it in "solution."

The temperature at which the visible water droplets occur is called the "dewpoint." This is a variable, based upon the amount of water vapor present in the atmosphere. The more water vapor present, the higher the dewpoint. Thus the dewpoint is really an index of the amount of water vapor present in the air.

There are two ways in which the temperature and dewpoint may be made to coincide—by raising the dewpoint until it equals the temperature, and by lowering the temperature to the dewpoint. The first results from the addition of water vapor to the air by evaporation from water surfaces, wet grounds, or rain falling through the air. The second results from the cooling of the air by contact with a cold surface underneath.

It is important for you to remember that when the temperature and dewpoint coincide you will get fog. Suppose you were flying cross-country and received a report from an airport weather station telling you the dewpoint was 51° and the temperature 55°. Then suppose a little later the temperature at the same airport was reported as 53°. You would know immediately that the temperature was approaching the dewpoint and you should make immediate plans for landing at an alternate airport where there was a greater spread between temperature and dewpoint.

Naturally other factors influence the formation of fog over an airport—light winds would make its formation more likely and so would smoke conditions from nearby factories. But the fact that the dewpoint and temperature are getting close together should be enough information to warn you to head for that alternate field.

There are several classifications of fog,

What happens when I pull the string?

"Yes, sir," said the bright young salesman. "Everything is automatic . . . everything is handy. Push this button . . . you're airborne. Push this button . . . you land on a dime. Set this dial . . . a three-minute egg. Flick this spigot . . . breakfast coffee. You couldn't ask for more convenience at home or in heaven. I could spend hours explaining the wonderful features . . ."

"Don't bother," said Mr. Bullington, bitingly. "Just tell me what happens when I pull the string?"*

*That, as the saying goes, Mr. Bullington, is the catch. A plane that works like Aladdin's lamp just isn't to be had . . . no matter how many strings you pull. Despite all the "miracles" developed in the last few years, it'll still take a little effort to fly 'em. That's why, until the automatics do come along, we suggest that you watch for the new, improved WACO . . . the plane that *is* comfortable, dependable and easy to fly . . . soundly designed and ruggedly built for all-weather performance . . . a better plane for better flying. THE WACO AIRCRAFT COMPANY, 42 Peters Avenue, Troy, Ohio, U. S. A.

ALL ARMY CARGO-TRANSPORT GLIDERS ARE WACO DESIGNED

WACO AIRPLANES

Waco

generally *air mass* fogs and *frontal* fogs. Air mass fogs, which occur more frequently, are caused by the cooling of air that is already moist until a high relative humidity is reached and the temperature and dewpoint meet. This cooling of the air produces *advection fog* and *radiation fog*.

Advection fog is formed when warm air flowing over a cold land or water surface is cooled to the dewpoint by contact with the surface. The fog may then be carried for long distances in the air stream.

Radiation fog is formed by the cooling of a land surface on clear nights by radiation to the sky. The air in contact with the cold ground is cooled to its dewpoint and fog forms, remaining in the vicinity.

Sea fog is the best-known and probably the most widespread type of advection fog. If warm air moves from the land over the colder sea, or is carried by the wind from over warm water to an area over colder water, it may be cooled to the dewpoint and sea fog forms.

When an on-shore wind carries warm, moist air from over warm water to cooler water off a coastline, fog forms over the cold surface. In the daytime, when the air reaches the shore, it encounters land which has been warmed by the sun and the fog dissipates.

At night, when the ground is cooler, the sea fog usually does not dissipate and frequently moves for considerable distance inland. If it encounters land obstructions, such as hills or mountains, its inland movement stops.

Warm ground and down-slope conditions tend to dissipate sea fog moving inland. This is particularly true during clear, warm days on the leeward side of islands. Air warmed by the ground on the higher plateaus and peaks of islands drifts down slopes on the leeward side. This causes the fog to dissipate sooner on the leeward side than in other areas around an island.

If there are no barriers the fog may spread for many miles inland. Winter fog from Texas has spread north as far as the Great Lakes. When the water is colder than the land and warm, moist offshore winds prevail and fog may form over the water and extend for many miles out to sea.

Steam fogs form over inland lakes and rivers on clear nights, especially in the late fall, before these bodies of water have frozen over. Ordinarily lake and river steam fogs are local and are not more than 300 or 400 feet thick, but they may be very dense. They are particularly important along the Mississippi and Ohio rivers, where many of the principal airports are located near the river banks.

These fogs form when there is a small separation of temperature and dewpoint early in the evening, when the air is comparatively stable, when winds are light but there is not a dead calm, and when the temperature of the lake or river water is so much higher than the temperature of the air above it that the evaporation from the surface of the water is so rapid that some of the vapor is immediately condensed as visible moisture.

In summer, when the land surface and the air above it stays warmer than the river temperatures all night, this type of fog cannot form.

When the wind carries air of sufficient moisture content up a slope it will form *up-slope fog* if it cools to the dewpoint. This happens in many regions where there are pronounced up-slope winds and proper humidity. Because the air is carried to lower pressures as it moves up the slope, it is cooled at the adiabatic rate, which means that its temperature falls as it expands, through dynamic cooling, rather than because of outside heating or cooling influence acting upon it. In the Great Plains region of the United States where there is a gentle rise of the ground to higher elevations toward the west, these up-slope fogs form frequently when there is an east wind and the air has a high moisture content.

The second major classification of air mass fog is radiation fog—which is really only ground fog under a scientific name.

Ground fogs usually form in the early morning hours, are densest an hour or two before sunrise, and burn off from two to four hours later. They are uncommon in the tropics but are quite frequent in the middle and high latitudes, except in the summer months when the land surfaces remain too warm during the night.

Stable air is a necessity to form ground fog because when colder, denser air is on the surface and warmer, less dense air prevails aloft so that it resists displacement. If the velocity of the wind is over six to 12 m.p.h., the surface inversion will be destroyed or the moisture will be mixed through a deeper layer of air by turbulence and no fog will form.

On the other hand, it requires a light wind to create a slight turbulence that is necessary to produce a cooling effect on several hundred feet of air upon which ground fog formation depends. Therefore, you are likely to find this type of fog when the surface winds are from four to six m.p.h. and when there is fairly high humidity in the evening.

Since ground fog is the type most likely to disrupt flying conditions, it is well to remember the conditions which produce it. Beware of ground fog when you find this combination:

1. A clear cool night which lets the land lose the heat that it gained from the sun during the day by radiation to space. A cloudy sky acts as a blanket that keeps the land surface warm, preventing radiation and formation of fog.

2. There is moisture at low levels, for the more moisture in the air next to the surface, the less difference between the temperature and dewpoint. Less cooling is thus required to bring temperature and dewpoint together. You can assume that the air is charged with moisture when the ground or grass is wet, as it is after a rain, or near lakes or streams.

3. Air is a poor conductor of heat, therefore if ground fog forms on a calm night it won't be more than two to four feet deep. But with a light wind, the cooling is spread through a deeper layer of air by turbulence or mixing, resulting in fog several hundred feet thick. A stronger wind (above six m.p.h.) will spread the cooling process through a layer of air so thick that no fog will form.

4. Remember that air next to the surface, when cooled during the night, drains down into valleys where it is trapped and held, just as water in a shallow pan. This increases the cooling process and intensifies the fog formation. Ground fogs, therefore, are most frequent and most dense in the lowlands.

Frontal fogs, as a rule, are more limited in extent than the air mass types of fog. This variety of fog may occur in advance of a front, may accompany the front, or follow along behind a front as it moves.

Sometimes fogs accompany a cold front but since they are confined to a narrow band in the vicinity of the rapidly traveling cold front they remain over one place not more than a few minutes at a time.

Warm front fogs, however, are more extensive and are a definite hazard to flight operations. They are caused by rain falling from the warm air into the cold air beneath the front, with resultant raising of the dewpoint until it reaches the proper temperature.

Since the precipitation band accom-

The GOLDFISH CLUB

The Goldfish Club was formed to recognize the thousands of pilots and aircrewmen who have ditched their aircraft at sea and saved their lives through the use of emergency life jackets and dinghies. To apply for membership in the American division of the Club, the following information should be submitted to the American Secretary, Max Karant, Managing Editor, FLYING, 185 North Wabash Avenue, Chicago 1, Illinois:

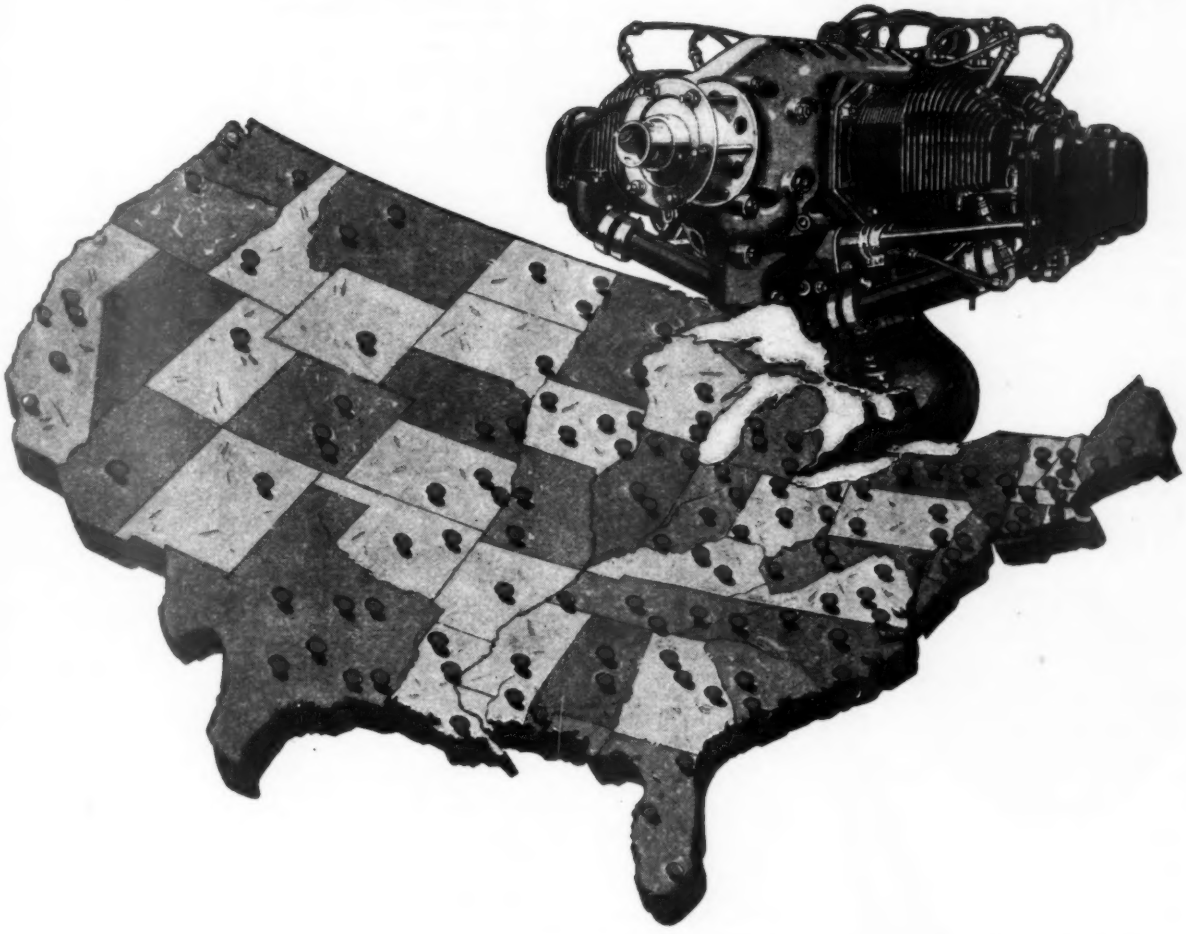
1. Name, rank and serial number
2. Service address
3. Home address
4. Date and location of incident
5. Description of incident
6. Signature of applicant
7. Signature of commanding officer

The first 65 members of the Goldfish Club, as they appear on the official club roster, were listed in the November, 1945 and January, 1946 issues of FLYING. This listing is continued below:

Arlen, Donald L., A
Klujsza, Casimir C., Jr., A
Menefee, Jack V., A
Greenwood, George A., N
Mason, George R., A
Jackson, Richard O., A
Binns, Donald H., A
Furey, Alfred A., A
Pierce, Stanley H., A
La Valley, W. F., Jr., N
Ulricksen, Rex W., N
Beathard, Roy I., N
Segerman, Elliott W., N
Weber, Ernest A., N
Lanz, Louie C. C., N
Mannarino, Salvatore M., N
Welshonce, James R., N
Nelson, George H., A
Ford, Charles M., Jr., A
Sheehan, James C., A
Freeman, C. M., M
Williams, Barthwell Lee, C
Florsheim, Seymour L., A
Sant, John M., A
Pearcy, John P., A
Kinsella, George, A
Klima, William, A
Ozman, Clarence B., A
Alexander, Russel E., A
Schmidt, Theodore J., A

A-Army, M-Marine Corps, N-Navy, C-CAP

It's never far to
CONTINENTAL PARTS & SERVICE



POWER BY
Red Seal Engines
CONTINENTAL

Every Continental Red Seal Engine Develops Its Full-Rated Horsepower

Just as there is no space limitation to the Continental-powered plane, so are there no geographical limits to Continental SERVICE. Wherever a Red Seal Engine takes you on the wide-open skyway, you enjoy the immeasurable satisfaction of knowing that Continental SERVICE was there first. Drop down at any recognized airport, and Continental SERVICE extends its welcome hand. That which makes this SERVICE possible is, of course, the fact that there are so many Continental-powered planes in the air.

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

Relax
WITH A
MARXMAN
THE PIPE OF RARE DISTINCTION

Men of discernment look for the MARXMAN name on the pipes they buy. It spells mellowness, sweetness, rare smoking qualities. It spells pipes made by skilled craftsmen from selected, aged briar roots . . . into distinctive shapes. Mass production methods are avoided. Each pipe is individually cut, rubbed, and polished.

AT FINE STORES

SUPER-BRIAR . . . the briar is selected for its perfection of grain pattern . . . the grain heightened to enamel-like smoothness and brilliance by rubbing and polishing. In your favorite shape. $5

BENCH-MADE...imported, seasoned briar skillfully carved by hand. This style offers men a grand adventure in sweet, cool smoking!

$5 $7.50 $10
Regular Large Massive

FREE
Interesting booklet for pipe smokers. Tells how to break in a pipe... shows how fine pipes are made. Address... Desk. 5D

MARXMAN
29 W. 24TH STREET, NEW YORK 10, N.Y.

panying a warm front is quite wide and the front moves slowly, this type of fog may cover a large region for considerable time. Warm front fog is particularly prevalent along the eastern seaboard of the U.S. where the cold water offshore and the general up-slope of the terrain are added factors which accentuate fog formation.

After the passage of a warm front, an advection type of fog frequently occurs in the warm air if the surface is much colder than the air moving in. Strictly speaking, this is not a frontal type of fog but is formed within the air mass itself by advective cooling.

The physical process by which fog is formed frequently depends upon a degree or two of variation in temperature or dewpoint. Certain local conditions of terrain may favor or hinder its formation, such as air drainage down slopes, a ground depression due to a river bottom, and the location of smoky industrial areas. Wind conditions are an influence on all these factors. For instance, in a factory area, wind from one direction will carry the smoke over the airport assisting in the formation of fog, while if the wind is from the opposite direction, the airport may remain clear.

Increasing winds will dissipate fog. So will heating from below caused by sunlight filtering down through the fog bank to the surface. Over the land, the heating of the ground by the sun makes fogs tend to thin out or even clear completely during daylight hours, thickening or reforming as the ground cools after sunset. Over the ocean this tendency is much less pronounced, and frequently the sun's action has no noticeable affect upon fog banks.

But never count on a fog moving away or dissipating. Don't circle around over *any* airport and wait for fog to clear. Head for an alternate airport or, if necessary, to any open emergency field, and land. Remember, there is no percentage in playing blindman's buff with an airport and no future for any pilot who plasters his plane against a control tower. END

Push-Button Warfare

(*Continued from page* 39)

sion, world-wide spy organizations, and the training programs necessary to insure successful "button-pushing", both defensively and offensively.

Visualize the potential destructive power of an atomic missile launched from a site thousands of miles from its target, capable of 3,000-m.p.h. speeds, guided to a specific area by either radio or television, equipped with a proximity fuse pre-set to detonate the atomic explosive at whatever height will assure maximum destruction, and you have a good idea of what push-button warfare implies.

Rocket propulsion will attain unheard of speeds. Original rocket research for the AAF was for the purpose of assisting take-offs of aircraft with heavy loads from small fields and to provide short-duration speed boosts to achieve a high emergency performance in combat. The enemy employed rocket power to propel offensive weapons. Notable were the V-2 rocket bomb, the *Rheintochter III*, a radio-controlled flak rocket which the Germans intended for use against our bomber fleets, and the *Viper*, a vertically-launched piloted rocket plane designed to attack aircraft with cannon, rockets or by ramming.

Certain weaknesses make the *Viper* unsuited for push-button war action. For example, its 620-m.p.h. speed would be too slow and its flight duration of but a few minutes would be inadequate for covering any appreciable distance. Further, direction of such a missile requires skilled manual guidance which means training of personnel capable of withstanding high acceleration forces. Its altitude would be limited to that at which a human can retain consciousness, even with pressurization and an oxygen mask.

Thus, as General Arnold states, we are forced to consider not only the likelihood, but the assurance that space ships, atom power and radio- and television-control will initiate the push-button technique in any future war. Decline of our present aerial warcraft is pointed out in General Arnold's statement: "The weapons of today are the museum pieces of tomorrow, when the B-29 will belong in the Smithsonian Institution along with the Wright and Lindbergh planes.

"Its place will be taken by bombers carrying 50 tons of bombs, powered with jet or rocket engines capable of taking such craft around the world at supersonic speeds."

Since atomic bombs have opened the door to a new phase of destruction, we must consider the possible defenses against them.

General Arnold advances three defense suggestions against such a weapon. "First, we should attempt to make sure that nowhere in the world are atom bombs being made clandestinely; second, we should devise every possible active defense against an atom bomb attack, once launched; and third, we might redesign our country for minimum vulnerability to atomic bomb attack by effecting a complete dispersal of our cities and moving vital industries underground."

Second among Arnold's suggestions—seeking an active defense—leads to the probable use of guided missiles which would seek out the speeding rocket-bomb and, through use of some device such as the proximity fuse, attempt to destroy it far above and away from its intended target, or deflect its course. If such a device can be perfected as defense against a 3,000-m.p.h. projectile which is propelled to an altitude of 70 miles, offensive tactics would soon necessitate the use of the space ships General Arnold predicts, operating outside the earth's atmosphere.

These space craft would launch their explosives closer to the target, making detection more difficult and subsequent time to put defense measures into operation much shorter. Propelling such missiles from varied and unexpected directions would tend to make the attack more

*By Flying Boxcar

Air Shippers have their eyes on inland ports—the small cities with limited length runways.

Their interest turns naturally to the Fairchild "Packet."

For the "Packet"—expressing the painstaking research and precise engineering typical of *all* Fairchild operations and products—can:

GET IN, fully loaded with up to nine tons of flying freight, on average and less-than-average length runways.

UNLOAD AND LOAD, swiftly, with a minimum of manipulation. The "Packet's" split-tail doors at the rear open up the entire width of the boxcar-like fuselage. The forward cargo door permits quick access to "up front" freight. The "Packet's" horizontal cargo floor is at truck-floor height.

GET OUT, fully loaded, with a short run. It has take-off characteristics highly exceptional for a plane of its large cargo capacities.

All these characteristics are invaluable to the shippers seeking to tap the rich markets of the interior. They are characteristic of the "Packet" alone among cargo planes, because the "Packet," from its conception, was designed and built *specifically* to carry cargo—efficiently and economically—anywhere! They are the Fairchild "touch of tomorrow" in this plane of today!

Cargo operators—write for details about the "Packet."

Fairchild Aircraft

Division of Fairchild Engine & Airplane Corporation, Hagerstown, Maryland

successful, the defense more vulnerable.

One vital bush-button warfare device, General Arnold stated, can be used offensively and defensively—the proximity fuse or some similar device based on its principle. This detonating apparatus is so sensitive that it is affected by the heat of a man's body should he step into a room where the fuse is activated. At long ranges, such a device might direct itself at an enemy's power plants or steel mills which radiate more heat than surrounding terrain or structures.

Offensively, an atomic-rocket bomb, independent of any form of guidance other than radio-control, equipped with a proximity fuse, could be directed to a target at supersonic speeds—a true push-button war implement. Defensively, a guided missile with a similar proximity fuse could be dispatched to seek out and destroy an offensive projectile by "homing" on the approaching missile. This would constitute a push-button defense.

Means of propelling these guided missiles is not confined alone to rocket power. When atomic energy was mentioned as a possible source of propulsive power, General Arnold stated that he believed, for the present, it was wisest to concentrate on the use of atomic bombs offensively rather than seek means of utilizing atomic energy for propelling aircraft. Such a development, he added, seems rather far in the future—so far that it is difficult to predict at this time the design, characteristics and types of aircraft, or space craft for ionosphere operation which may be propelled in this fashion.

This opinion is not shared entirely by some atomic experts, who believe that we are fairly close to harnessing this basic energy.

Adaption of such energy for rocket propulsion may be the answer to balancing the disparity in size, weight, fuel and explosive that was so disproportionate in the German V-2. Despite its tremendous size and weight, the warhead contained only one ton of explosive. Our present fuel is somewhat better than the alcohol-oxygen combination used by the Germans but is not efficient enough yet for economical long-range operation. Once this problem is overcome and the rocket's arc can be controlled by either radio or television, a huge warhead filled with atomic explosive detonated by the sensitive proximity fuse will make this push-button projectile a frightening possibility.

Other forms of jet propulsion may be used to attain the tremendous speeds demanded by piloted or pilotless aircraft and missiles. The German V-1 proved the feasibility of bomb attack using a simple pulse engine. However, its gyro-controlled flight was inaccurate and the jet-bomb itself was vulnerable to attack by fighter planes of greater speeds and to radar-controlled antiaircraft fire.

In a push button war, pilotless jet aircraft, radio- or television-controlled, will supplement the piloted fighter craft. Bell Aircraft has already successfully adapted radio-control to its *Airacomet* which has been test-flown pilotless. Curtiss-Wright has devised a radio-controlled "flying device" which has attained a speed of 1,400-m.p.h. Both are steps toward development of the push-button technique.

Some of the jet propulsion combinations that could be utilized in a robot war are (1) *motorjet*—a reciprocating engine plus ducted fan, (2) *turboprop*—a gas turbine plus ducted fan. (4) *turbojet*—a gas turbine plus jet, (5) *ramjet*—a continuous jet with compression by aerodynamic ram, and (6) *pulsojet*—an intermittent jet. The importance of these forms of power in any future war is underlined by General Arnold's comment: "Right now these strange-sounding words carry more meaning for Americans than any other six words I know."

Defense against a push button war is not confined solely to electronic and atomic machines. Our intelligence must be developed in proportion to our scientific advance. General Arnold emphatically pointed out that "our past concept of intelligence needs was insufficient to cover the needs of modern war."

Maintenance of a sound defense against the terrors of push button warfare means obtaining detailed and moment-by-moment knowledge of all aspects of civilian and military activity within the territory of an enemy or potential enemy. This includes continuous knowledge of this potential enemy's political, social, industrial, scientific, and military life in times of peace as well as in war.

We must remain abreast, said General Arnold, of all facilities that may affect possible military operations. Future targets may be very large or extremely small—such as guided missile launching sites—requiring exact advance intelligence information to insure their destruction by accurate bombing. The importance of scientific intelligence grows when one realizes that obliteration of such targets in a push button war would probably be assigned either to pilotless radio-controlled aircraft, or television-guided rocket bombs.

Integrating the factors that comprise a push button war would possibly make a future invasion of any enemy country follow a pattern somewhat like this:

First, the launching of television- or radio-guided rockets with devastating atomic-bomb warheads from sites far removed from the target. This could be the initial "softening-up," with such an attack supplemented by ionospheric space ships launching similar atomic bombs with proximity fuses set to explode at the height that will create the most widespread destruction. Radar sets with anti-jamming devices would scan the defensive areas for signs of retaliatory missiles, at the first sign of which guided missiles would be sent skyward to intercept, de-

AAF TALLY IN EUROPE

AAF aircraft flew 1,690,371 sorties in the European war. Of this total, heavy bombers flew 30 per cent, but accounted for 70 per cent of the total bomb tonnage. AAF planes destroyed 20,609 enemy craft in the air—45 per cent were downed by heavy bombers; fighters destroyed 52 per cent.

Plane Types Used	Sorties	Bomb Tonnage	Enemy A/C Dest. In Air	Enemy A/C Dest. O.G.	Enemy A/C Damaged Air & Grd.[1]	U.S. Losses on C.M.	C.M. Loss Rate Per Sortie
B-17	291,508	640,036	6,659	418	4,603	4,688	1.6%
B-24	226,775	452,508	2,617	352	1,932	3,626	1.6%
Heavy Bomber TOTAL	518,283	1,092,544	9,276	770[2]	6,535	8,314	1.6%
B-25	63,177	84,980	193	189	139	380	0.6%
B-26	129,943	169,382	402	117	454	911	0.7%
Medium Bomber TOTAL	193,120	254,362	595	306	593	1,291	0.7%
A-20	39,492	31,856	11	.....	25	265	0.7%
A-26	11,567	18,054	7	.....	6	67	0.6%
Light Bomber TOTAL	51,059	49,910	18	.....	31	332	0.7%
A-36	23,373	8,014	84	17	52	177	0.8%
P-38	129,849	20,139	1,771	749	1,951	1,758	1.4%
P-39	30,547	121	14	18	5	107	0.4%
P-40	67,059	11,014	481	40	341	553	0.8%
P-47	423,435	113,963	3,082	3,202	4,591	3,077	0.7%
P-51	213,873	5,668	4,950	4,131	4,218	2,520	1.2%
P-61	3,637	141	58	.....	11	25	0.7%
Spitfire	28,981	212	256	3	184	191	0.7%
Beaufighter	6,706	.....	24	.....	27	63	0.9%
Mosquito	449	.....	.....	.....	.....	10	2.1%
Fighter TOTAL	927,909	159,272	10,720	8,160	11,380	8,481	0.9%

(1) Includes probably destroyed and damaged

(2) ETO Monthly Summary lists 3,079 enemy aircraft damaged or destroyed on ground by heavy bombers. No indication of model or extent of damage given.

RADIO COMMUNICATION FOR SMALL AIRPORTS

- *Complete station in one purchase*
- *Push-button controlled*
- *Experienced operators unnecessary*

The Aireon Type RS-1 radio station is a complete, self-contained, simple-to-operate unit, specifically designed to meet the requirements of a small airport. The transmitter is rated at 50 watts output and readily portable, and also makes an ideal emergency station. The type RS-1 radio station is also available with the proper frequency ranges for tower operation. ***Descriptive brochure with specifications FREE on request.***

Aireon MANUFACTURING CORPORATION

Radio and Electronics, Engineered Power Controls

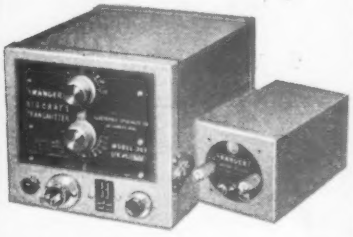
FAIRFAX AND FUNSTON ROADS, KANSAS CITY 15, KANSAS

AV. CIPRES 64, MEXICO, D. F.

For the FINEST in AIRCRAFT RADIO fly WITH RANGER

Time and again users of the new RANGER aircraft radios have said, "They give airline performance for the private flier. They're the finest I've ever seen in aircraft radio at any price." This has been RANGER'S aim — adding, "at private flying prices."

The Model 116/209 two-way combination, for example, demonstrates this aim. The entire operation of the receiver and transmitter is centralized on the instrument panel — you need only to press the "mike" button and you're on the air with a wallop. The advanced RANGER design makes possible trailing wire performance with a single fixed antenna . . . antenna switching is automatically done with relays in the transmitter.



The "116" receiver is a 5-tube superheterodye unit with extremely high selectivity and sensitivity. It is powered by the "209" transmitter, and is its remote control. Range, 195-410 KC. The "209" 12-volt transmitter has over 15 watts output. No pilot-tuning, no gadgets . . . it is tuned and locked when installed. The 116/209 installation weighs less than 16 pounds *complete*.

RANGER VHF equipment will be ready when CAA VHF facilities are established. Present frequencies will be continued for several years after VHF ground equipment is installed. Authorities advise that it will be two years before VHF will be generally available in ground stations.

Free RANGER PILOT AIDS

Pocket-Size Range Station Finder. Lists all Radio Range Stations in the United States by call-letters and location.

RANGER Radiotelephone Procedure Manual. A basic training manual in fundamentals of Aircraft Radiotelephone Procedure.

Send for these booklets today.

RANGER AIRCRAFT RADIO
Division of
ELECTRONIC SPECIALTY COMPANY
3454 Glendale Blvd., Los Angeles 26, Calif.

flect or destroy the defensive rocket bombs.

Airborne armies—numbering into the hundreds of thousands, armed with the latest weapons could follow the atomic rocket-bomb attack, flying to the scene of attack at high speeds in planes powered with some form of turbojet or similar engines. These craft could be followed closely by long trains of supply aircraft.

Tactical support of attacking forces might be provided by huge bombers carrying 50 tons of high explosives. Fighter cover could be maintained by pilotless rocket or jet aircraft capable of supersonic speeds, guided either by television or radio from monitor stations on the ground or aloft in a control plane.

While such concepts of war stagger the imagination, the words of General Arnold plus the concrete evidence established by scientific advancement show clearly what we would face should there be another war. The rubble of Germany and Japan today would be mild compared with the havoc of tomorrow.

Adequate preparation for such an event, General Arnold indicates, is an urgent requirement.

"While this country must employ all of its physical and moral force in the cause of peace, it must recognize that real security against atomic weapons in the visible future will rest on our ability to take immediate offensive action with overwhelming force." END

How to Fly in Winter

(*Continued from page 83*)

preparation. You will probably want to change to oil of a little lower viscosity, and have your carburetor heater and cabin heater checked to be sure they operate properly with no leakage. Consult a competent mechanic before sealing up the front vent which admits air to the engine because you don't want to suffocate your engine. With these few preliminaries, the rest of the technique is up to you. Here's what to watch for:

CODDLE YOUR ENGINE. Just as a cup of hot coffee puts you in the mood to leave the house on a cold morning, so must you give your engine an opportunity to get thoroughly comfortable in the mood for flight before you can expect it to perform satisfactorily. Hot oil is the answer. This does not mean necessarily that the oil should be drained out of the crankcase and preheated, though in sub-zero weather that would be advisable. When oil is cold it cannot flow properly through the lines and provide lubrication at vital points. More than half of the lightplane accidents in winter are caused by pilots who attempt to take off with constipated engines.

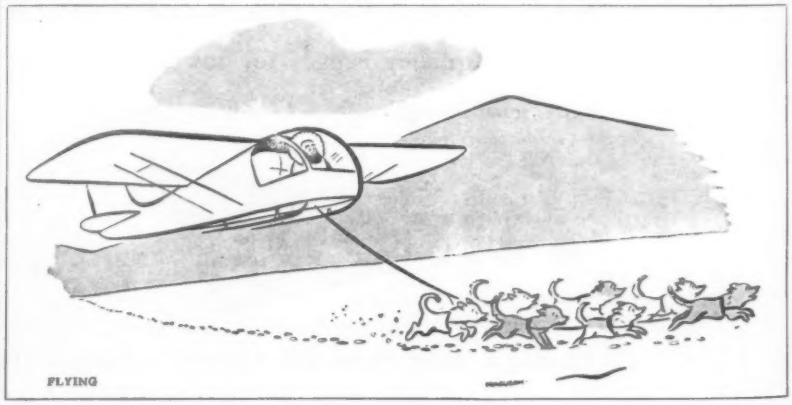
CHECK THE GASCOLATOR. Water in the fuel is particularly dangerous in cold weather because it may freeze in the lines during flight and stop the flow to the carburetor. Whenever possible it is good practice to fill the gasoline tanks immediately after a flight and before hangaring the plane. This eliminates all air from the tanks and thus prevents condensation of moisture. In any event, you should check the gascolator to be certain that it is free of water.

TURN THE PROP BY HAND. Your engine needs limbering up before it is ready to start. Turning the propeller over by hand loosens the congealed oil and (on a radial engine) removes oil from the cylinder heads, where it tends to collect.

USE THE PRIMER. On a cold morning a few shots of straight gasoline from the primer is an excellent eye-opener for your engine, but don't overdo it. Too much will make it groggy and unreliable. And be sure to lock the primer so your engine can't steal a quick one on the side during flight. Many a pilot who has been careless in this respect has found that his engine had plenty of stimulus under full power but conked out when throttled back for the landing glide.

WATCH THE PRESSURE. As soon as the engine starts, the oil presssure gauge needle will move over to the pin, registering extreme pressure. As long as it remains there the throttle should be kept in *idling* position. When the pointer moves back toward normal operating pressure, the throttle should be advanced. In cold weather, the oil warms slowly during the run-up and it is not necessary to wait for it to reach normal temperature before taking off. The pressure gauge alone gives adequate assurance that oil is circulating and providing proper lubrication.

FINAL ENGINE CHECK. As you advance the throttle, keep an eye on the pressure



Solar Exhaust Manifold *"In Action"*

THE ABOVE PHOTOGRAPH, taken in complete darkness without artificial lighting, dramatically shows the intense heat Solar airplane exhaust manifolds experience in service. This punishment goes on hour after hour for thousands of hours—a striking testimony to Solar workmanship.

During the past 15 years, Solar has fabricated over 300,000 engine sets of airplane exhaust equipment representing more than 1000 designs. The "know-how" gained extends over all stainless steel forming techniques from deep drawing to precision casting.

If your problem is manufacturing heat or corrosion resistant products from stainless steel or other high temperature alloys, consult Solar. Wire or write for helpful information.

ARMY ★★★ E NAVY
ARMY ★★★ E NAVY

SOLAR

STAINLESS STEEL PRODUCTS

SOLAR AIRCRAFT COMPANY ★ SAN DIEGO 12, CALIF. ★ DES MOINES 5, IA.

gauge to see that it does not jump to extreme position. As soon as you can move the throttle smoothly from idling to full power without forcing the pressure needle to the pin (or beyond the maximum operating pressure if the dial is so marked) the engine is ready for take-off —provided, of course, that it will also rev up to the normal r.p.m. By this time the oil temperature gauge will show some increase but it may not reach normal until the flight has progressed for some time.

DON'T TAKE CHANCES. Remember that oil is the life-blood of your engine. If it doesn't flow, the engine dies of anemia; if the pressure becomes too high, the engine suffers a stroke of apoplexy. And don't forget that failure from these causes is most probable during take-off, at a time when the engine must be depended upon for its maximum power. The oil pressure gauge is the engine's pulse. Most oil gauges on light aircraft are connected directly to the oil line. A number of cases are on record where excessive pressure has caused the gauge to burst and squirt hot oil in the pilot's face. During recent years some improvements have been made to reduce this possibility but the danger is always present. If the pressure becomes too high, the connecting hose may be forced off the oil line. This is also dangerous because the hose may lie in such a position as to register some amount of pressure even while the oil is pouring out of the engine.

WIPE OFF YOUR WINGS. Some winter accidents are caused by attempting to take off when there is snow, frost, or ice on the airfoils. A pilot not familiar with the principles of aerodynamics might feel that a light covering of frost on the wings would not seriously interfere with flight —in fact, many fatalities can be traced directly to this misconception. Frost consists of minute ice particles adhering to the wing surfaces. Each particle offers resistance to the flow of air, resulting in a marked increase in drag. As a consequence, the airplane may be unable to gain sufficient speed to leave the ground within the limits of a runway, or, after becoming airborne, may not be able to climb rapidly enough to clear obstacles in the flight path. Snow and ice are equally dangerous—more so because in addition to increasing drag and adding weight, they adhere to the wings in such a way as to destroy the shape of the airfoil. Thus, instead of flowing smoothly over the wings, the air is forced to follow the contour established by the foreign substance, with a resulting decrease in lift efficiency. The wise pilot will always remove all traces of frost, snow, and ice.

CHECK YOUR CONTROLS. Immediately before take-off check all controls to be sure that ice has not formed in any vital parts so as to prevent smooth operation. If take-off involves taxiing through slush or water, there is a possibility that the wheels may freeze after leaving the

men with new ideas are going places in W.L. Douglas Shoes

The BEACON Style No. 4645

$6.50 to $8.50

Other Styles $5.50

Denver West Slightly Higher

SERVICEMEN!

You'll find a cordial welcome ... and the style of shoe you prefer ... waiting for you at your W. L. Douglas Store!

W.L. Douglas

W.L. DOUGLAS SHOE CO.

Shoes

BROCKTON 15, MASS.

Stores in Principal Cities—Good Dealers Everywhere

LANDING SLIDE RULE

A NEW slide-rule landing computer developed by Capt. S. P. Saint, engineering pilot for American Airlines, speeds the landing of transport planes under instrument conditions.

In one experiment, five transport airplanes flying under simulated instrument conditions were directed to landings on a single runway in 16 min. 40 sec. with the aid of slide-rule More than 60 minutes would be required to land the same number of planes using ordinary let-down procedures.

Using the slide-rule, the ground controller can compute accurate headings and flight time for aircraft making their let-down and final approach, and radio clearances much more rapidly.

Captain Saint believes further development will be required before the system will go into operation on commercial airways.

Unnamed, Unknown, Unsung but Still... 1st

After compiling more "firsts" than any of its combat sisters, the Honeywell test bomber, a B-17 Flying Fortress, has been officially grounded, never to fly again.

Stripped of turrets, guns and armor plate, the bomber, designated as 41-19210, but called 210 by its crew, is being transferred to the University of Minnesota's Aeronautical Engineering Department by ATSC after serving more than three and one-half years in Minneapolis as the dogship for a long list of automatic control devices jointly developed by technicians of the company and the Air Forces.

The Honeywell test ship was the

1. **First bomber equipped with an electronic automatic pilot**
2. **First plane equipped with an automatic leveling bombsight**
3. **First plane equipped with a steering motor tying in radar with flight control**
4. **First plane equipped with an electronic formation stick**
5. **First plane equipped with electronic, four-engine turbo supercharger control and many firsts in blind landing equipment.**

From these accomplishments you can readily see how Honeywell creative engineering can and will help you improve performance of all types of aircraft.

The Honeywell program includes a complete flight research department, test aircraft, and thousands of dollars worth of testing equipment. In addition, trained application engineers, with broad experience in the use of aeronautical and industrial controls, will collaborate with aircraft manufacturers and airlines in developing the most practical equipment for each specific problem. Their work includes consulting service and flight testing at the customer's plant. These men can help you in the application of Honeywell equipment to your control problems.

Minneapolis-Honeywell Regulator Co., Aeronautical Division, 2671 Fourth Avenue So., Minneapolis 8, Minnesota. Branches and distributing offices in all principal cities.

CREATIVE ENGINEERING

Makers of the famous M-H Electronic Autopilot, used on AAF four-engined bombers

MINNEAPOLIS Honeywell

CONTROL SYSTEMS

ground. Nothing can be done to counteract this. But if such a condition is likely, the pilot should use precaution in landing, since frozen wheels would have the same effect as if the brakes were fully on and could cause the plane to nose over. The best procedure to reduce this hazard is to land slowly in full-stall position, or bring the plane in with power for a power-stall landing. It may also be helpful to adjust the stabilizer to the tail-heavy position. Any indication of nosing over should be countered immediately by a momentary application of full power. In landing on slick or icy runways the pilot should realize that the application of brakes may initiate a vicious ground-loop. It is best, therefore, to land as near the beginnning of the runway as possible in order to have maximum space for decelerating without brakes.

USE YOUR CARBURETOR HEAT. An engine can operate properly only when the fuel is thoroughly vaporized. If the air entering the carburetor is too cold it will not mix properly. The engine will run rough at cruising speed and may stop completely when reduced to idling. The carburetor heater pre-heats the air to insure proper mixing temperature. Most engines will operate better with the heat full-on whenever air temperatures are below freezing. Of course, the heater should always be turned on when the engine is idling in flight, even during summer operation.

WATCH FOR CARBURETOR ICING. A more important use for the carburetor heater is to prevent the formation of carburetor ice. When the engine is operating, the carburetor acts like a highly efficient refrigerator. Vaporization of gasoline reduces the temperature so rapidly that air passing through the intake may drop as much as 40° within a fraction of a second. This sudden cooling causes the moisture in the air to condense, and if the temperature of the mixture reaches 32° ice will form in the induction system, clogging the passages, changing the fuel-air ratio, and making the mixture too lean or too rich.

Unless icing is checked immediately by application of carburetor heat, it may build up to such an extent that it will cause complete engine failure. The amount of moisture in cold air is usually insufficient to constitute a serious carburetor-icing condition, but if the humidity is high, or there is visible moisture, the carburetor heat should be used to forestall trouble. In the carburetors used on lightplanes the refrigerating effect is sufficient to produce ice when the outside air temperature is as high as 75°.

Your first indication will be a falling-off in r.p.m.s with a constant throttle setting. If your engine should slow down unexpectedly when you are flying under the conditions described above, be sure to put on full carburetor heat immediately.

In fall and winter weather there is no danger of overheating your engine through the use of preheated air and many pilots leave the heater on at all times. During very cold weather it warms the air sufficiently to insure good vaporization; in temperatures above freezing it counteracts temperature loss through vaporization of the fuel and thus prevents carburetor icing.

KNOW YOUR WEATHER. To enjoy winter flying you should check your weather carefully. In many ways winter weather is more satisfactory than summer weather. It is far more stable, free from sudden local showers, shifting winds, and unexpected air currents. On the other hand, you must remember that in winter fronts move more rapidly; wind velocities are usually higher, and snow cuts down your visibility more drasticallly than summer rains. Then, too, your flights may be subject to icing conditions which are always dangerous. Any ice which forms on the wings during flight destroys the shape of the airfoil and thus reduces aerodynamic efficiency. Unless your plane has de-icing equipment, stay on the ground when freezing rain or mist is falling.

Winter weather is not so whimsical as summer, thus the predictions of weather forecasters are more reliable. The chances are better for completing a flight as planned. However, you should never hesitate to turn back when the weather appears unfavorable. Even the most elaborately equipped planes flown by professional pilots have plenty of trouble in bad weather, and you cannot expect a lightplane to perform miracles.

Coddle your engine, keep your wings clean, use your carburetor heat, avoid bad weather, and above all, *don't take chances!* Follow this advice and you can became a life member of the fast-growing group of winter-flying enthusiasts. END

Now Available! Write for delivery date or see your dealer

•

This Funk plane, widely known and having endorsement throughout aviation circles, will be now known as the Funk BEE. It's your safe plane, recognized as practically spin-proof and stall-proof, yet speedy and maneuverable. Write for Free Descriptive Catalog.

Funk
AIRCRAFT CO.
COFFEYVILLE, KANSAS

London Letter

(*Continued from page 50*)

Goblin and *Derwent* turbojets have centrifugal compressors and axial turbines. Other new British jet engines have been produced by Metropolitan Vickers and by Armstrong Siddeley. The Armstrong Siddeley has an axial flow compressor and gives 2,600-pound static thrust. Diameter is 42 inches, weight 1,900 pounds.

Civil Aircraft Production

The Ministry of Supply and Aircraft Production is now producing 190 civil aircraft. With other orders, output will be 45 per month by the end of 1945 and 70 per month by June, 1946.

Eire Question Mark

Eire is the enigma of transatlantic aviation. She has prepared her new great airport at Rineanna and has already received there aircraft from many parts of the world.

Thus Eire destroys Britain's bargaining power, for anyone desiring to travel to England would be as ready to use Rineanna (on the Shannon) as an airport in England itself.

A new agreement between British Overseas Airways and Eire was in negotiation between General Critchley and Mr. Lemass in October, though at this writing no details had been released as to whether it had been completed. END

Greater radio range

with your GE Flying Radiofone

Talk to control towers or radio range stations—next town, county, or state. Listen to broadcast stations—for pleasure or for homing. Do that consistently, then you will know the solid satisfaction of flying with a flight-tested G-E Flying Radiofone.

Combining a super-sensitive and highly selective receiver with a transmitter that delivers a full 12 watts of power, the Flying Radiofone offers to the private flyer increased radio range and clearer message reception.

The G-E Flying Radiofone is styled to add real beauty to any instrument panel. Small, compact, and sturdy, it will withstand every condition of flying. The new G-E plug-in feature makes installation easier—removal instantaneous and effortless.

Write today for the facts about this outstanding personal plane radio.

Electronics Department, Section 152-E2,
General Electric Company,
Schenectady 5, New York.

- Longer Range
- Clearer Reception
- Low Battery Drain
- Simple to Operate
- Dependable 2-Way Communication with Fixed Antenna
- Range Voice Filter
- Long Tube Life
- Loop Operation
- 12 watts, Carrier Power Output
- 12 Tubes
- Weight only 12 lbs.
- Compact
- Plug-in Design for Easy Removal
- Reasonably Priced

Write for your free copy of the brochure describing the new G-E Personal Plane Radio.

THE G-E MONOGRAM FLIES IN ALL U. S. ARMY AND NAVY AIRCRAFT

GENERAL ELECTRIC

152-E2

Stop Blaming the Pilot!

(*Continued from page 25*)

difficult to determine. In airplane models having a high frequency of accidents of this type, it was found that the landing gear and flap switches not only looked and felt alike but were placed side by side, where they invited a sure case of mistaken identity. The solution required no scientific formula, just the application of common sense. The two switches were separated and redesigned to make it hard for the pilot to confuse them and while this remedy was not fool-proof it was, as one manufacturer put it, "fool-resistant."

After these modifications were made, "pilot error" was substantially reduced. For example, in one training model there had been 78 accidents involving flap and gear confusion during the year prior to the modification. In the next 10 months, despite an increase in the amount of flying, there were only seven accidents of this type. The real confusion turned out to be in the analysis of these accidents. Careless operation had been mistaken for thoughtless design.

The case of the flap and gear switches is typical and it has a specific application as far as the personal plane is concerned, since retractable gear is now being installed in many lightplanes. But it also provides evidence to substantiate the general principle that if the highest possible standard of safety is to be achieved in aviation—the first step is to make the plane itself as safe as possible.

Another example of the relation between pilot error and aircraft design is provided by the numerous wheels-up landings which resulted from forgetting to lower the landing gear. The accident investigator was rightfully concerned over the carelessness leading to such accidents, but again it was apparent that charging pilots with being forgetful did very little to make them remember.

Eventually it was discovered that failure to remember the landing gear was closely related to the type of warning device installed in the cockpit. The most forgetful pilots turned out to be those whose planes were equipped only with a warning light, while those with the best memories were flying aircraft equipped with warning horns. In other words, you have to be looking to see a light but you don't have to be listening to hear a horn. So horns were installed where they were needed and one more safety factor was added to help the pilot.

For a long time the pilot has been reproached for the constant trouble he gets into on the ground. During 1944, in the continental United States, the AAF had over 2,000 taxiing accidents which resulted in major damage and nearly as many again which involved only minor damage. Taxiing has also been a big problem in private flying for during the past 15 years there have been over 5,000 taxi accidents in non-scheduled aircraft. Last year alone, 500 private aircraft accidents occurred during taxiing—and, although 98 per cent resulted in no injury to personnel, the extent of the damage leaves little wonder that insurance rates are high. In 83 out of 100 cases the replacement of a major assembly was required and in 16 out of 100 an overhaul was necessary to make the plane airworthy.

The Army has learned some lessons about these taxiing difficulties, some of which the private aviation industry might use to good advantage. At first the same old bugaboo of pilot error provided an explanation for taxi troubles. Most of the time the pilot was accused of failing to look where he was going. To read the accident briefs you would think that pilots as a class just don't care where they are going. They would bump into oil drums, tractors, trucks, automobiles, snowbanks, parked aircraft, fire extinguishers, energizers, and each other.

The first question raised by this conglomeration of objects was—what were they doing on the airport? Why were miscellaneous obstacles being left on the runways, why were airplanes parked where they got in the way, why was snow piled steeply along the runways, and why was all description of motorized equipment permitted to wander uncontrolled over the airport?

In most cases the answer was sloppy airport management and antiquated concepts of airport design. As a matter of interest, it might be added that most of the troubles familiar for many years on the highway seemed to have been transplanted to the airport: fixed obstacles close to the traveled way, soft shoulders, inadequate control of traffic, dangerous intersections, congestion, inadequate lighting, and dangerous parking practices.

Most of the things that pilots were hitting, then, or nosing up to avoid hitting, should never have been there. But equally significant was the fact that though they were there, pilots still did not see them in time to prevent accidents. The reason for this was hinted in the fact that while the pilots of some aircraft models were bumping into things at the slightest provocation, the pilots of other models would taxi with the utmost decorum. When it turned out that the high collision rates were in the conventional-geared aircraft with tail wheel and the low rates were in aircraft equipped with tricycle gear the secret was out. It was the airplane that was blind, not the pilot.

There are many factors that enter into the accident picture: the design of the aircraft and its maintenance, the instructor, the pilot who flies it, and all of the facilities and services which must be provided to make efficient operation possible, including airports, communications weather service, and aids to navigation. To single out the pilot as the principal cause of accidents is very often a superficial judgment. It is true that the pilot is generally the last person in position to stop an accident, but a lot of other people are in position to get one started. That is the key to accident prevention: stop them from getting started.

Judging from the pre-war private plane accident rate, even a continued improvement during the next few years will mean a heavy toll and a definite obstacle to maximum expansion of personal flying.

Aircraft designed with simplified and standardized cockpits and controls and built with safe operation in mind provide the first step toward ultimate high standards of safety. Until this is universally accepted and acted upon, we haven't taken the first step.

The time to prevent accidents is before they happen and the time to get busy doing that is now. Why not abandon the theory that the pilot is always wrong? He can't be because the pilot, it so happens, is the customer. END

FLYING

"It's his first view of a tree from this angle!"

BEST BUY IN THE SKY!

TAYLORCRAFT

• **GREATER AIRABILITY**—Taylorcraft is time-tested, sky-bred and sky-proved! Will out perform any ship in its class—in Speed, Altitude and Endurance

• **GREATER SPEED PER HP**—Greater Speed range from low to high than any other light plane in its class. Lowest, safe landing speed—fast smooth cruising speed

• **MORE PROVEN SAFETY**—Here is precision control which permits the pilot to exercise his own ability and judgment rather than rely on mechanical controls which permit no freedom of action in emergencies.

• **BETTER CONSTRUCTION**—Of 6500 Taylorcrafts built in the past ten years, not one has been found to have a structural failure. PROOF: CAA records!

• **LOWER OPERATING COST**—War training school operators have proved Taylorcraft costs less to maintain than any other plane in any class at any price!

• **SWIFTER TAKE-OFF**—Taylorcrafts will operate out of the smallest fields. Landing roll is only 300 feet! Best high altitude take-off performance.

• **MORE ALL-AROUND PERFORMANCE PER HP—and HP costs money!**

• **GREATER BEAUTY AND COMFORT OF INTERIOR**

• No wonder the thousands who own and have owned Safe T'Crafts over the past 10 years are so intensely loyal! All who see and fly the new Taylorcrafts agree—Dollar for Dollar—Feature for Feature—Taylorcraft has earned the reputation

"BEST BUY IN THE SKY"

VICTORS! Because you weren't here to place an advance order for your favorite personal plane, we at Taylorcraft have reserved 25% of our entire production for your needs. Just show your discharge papers—and go to the head of the line.

Write: **TAYLORCRAFT AVIATION**, Dept. A, Alliance, Ohio

Taylorcraft

World's Largest Builders of Two and Four Passenger side-by-side Airplanes

TAYLORCRAFT IS TAKING ORDERS AND DELIVERING PLANES TODAY

FREE!

The famous 64-page, fact-packed book that has stimulated thousands of men!

"Forging Ahead in Business" is a practical, thoughtfully-written book with "punch" and common sense on every page. It carries a message of vital importance to every man who wants to make more money, get a better job and improve his station in life.

Partial Contents:

- Law of Success
- Forging a Career
- Organized Knowledge
- Highway of Achievement
- Making Decisions
- Failure and Success

Noted Contributors

Among the prominent men who have contributed to the Institute's training plan, which is described in "Forging Ahead in Business," are: Thomas J. Watson, President, International Business Machines Corp.; Clifton Slusser, Vice President, Goodyear Tire & Rubber Co.; Frederick W. Pickard, Vice President and Director, E. I. du Pont de Nemours & Co.

Simply return the coupon below, and your FREE copy of "Forging Ahead in Business" will be *mailed* to you.

MAIL COUPON TODAY

ALEXANDER HAMILTON INSTITUTE
Dept. 362, 71 W. 23rd St., New York 10, N. Y.
In Canada:
54 Wellington Street, West, Toronto 1, Ont.

Please mail me, without cost, a copy of the 64-page book—"FORGING AHEAD IN BUSINESS."

Name.....

Firm Name.....

Business Address.....

Position.....

Home Address.....

'The Bite'

(*Continued from page 22*)

charges are $10 at 158 airports, $8 at 121, $9 at 104.

Most prevalent hangar rates were $1 a day at 148 airports, $1.50 at 92, $15 a month at 73, $10 at 30, $20 at 12.

Here are summaries of the regional survey, conducted by AOPA:

Lightplane rates for solo and dual time at 112 airports in nine east coast states — Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Vermont:

	High	Low	Most Prevalent Rates
Solo	$ 9.50	$5.00	$9 at 9 airports
			$8 at 55 airports
			$7 at 26 airports
			$6 at 13 airports
Dual	$12.00	$7.00	$11 at 10 airports
			$10 at 60 airports
			$9 at 23 airports
			$8 at 10 airports

In the same area, of 104 airports reported, hangar rentals were as follows:

	High	Low	Most Prevalent Rates
Per day or night	$2	$0.75	$1.50 at 11 airports
			$1.00 at 21 airports
Per month	$30	$7.50	$20 at 12 airports
			$15 at 21 airports

Lightplane rates for solo and dual time at 235 airports in 17 middlewestern and Rocky Mountain states—Idaho, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Utah, Wisconsin, and Wyoming:

	High	Low	Most Prevalent Rates
Solo	$12.50	$4.00	$8 at 35 airports
			$7.50 at 12 airports
			$7 at 79 airports
			$6 at 47 airports
Dual	$15.00	$6.00	$11 at 15 airports
			$10 at 65 airports
			$9 at 51 airports
			$8 at 53 airports

In the same area, of 230 airports reported, hangar rentals were as follows:

	High	Low	Most Prevalent Rates
Per day or night	$3	$0.50	$1.50 at 55 airports
			$1.00 at 69 airports
Per month	$30	$5.00	$15 at 25 airports
			$10 at 22 airports

Lightplane rates for solo and dual time at 116 airports in 11 southern states and the District of Columbia—Alabama, Arkansas, Florida, Georgia, Kentucky, Mississippi, Oklahoma, Tennessee, Texas, Virginia and West Virginia:

	High	Low	Most Prevalent Rates
Solo	$10.00	$3.50	$8 at 28 airports
			$7 at 31 airports
			$6 at 40 airports
Dual	$12.00	$6.00	$10 at 20 airports
			$9 at 24 airports
			$8 at 52 airports

In the same area, of 107 airports reported hangar rentals were as follows:

	High	Low	Most Prevalent Rates
Per day or night	$2	$0.75	$1.50 at 26 airports
			$1.00 at 48 airports
Per month	$20	$7.50	$15 at 15 airports
			$10 at 8 airports

While the above rates apply to the conventional lightplane types—*Cub*, Aeronca, Taylorcraft, Luscombe—a newer design in the lightplane field, the two-control *Ercoupe*, has struck such a responsive note with the hitherto non-flying public that fixed base operators have been exploiting the *Ercoupe* rather extensively. While they privately make every effort to sell prospective buyers one of the conventional types they happen to have on hand, many fixed base operators have paid as much as $4,000 for second-hand *Ercoupes* (cost new: $2,600) so as to cash in on the demand. That has resulted in rental charges on this 65-h.p. monoplane ranging from exorbitant to normal for the same horsepower class. These hourly *Ercoupe* rental charges are indicative:

	Dual	Solo
Southeast Air Service, Inc., Atlanta Ga.	$14.00	$10.00
Sky Harbor Airport, Chicago, Ill.	13.00	10.00
Anderson Air Activities, Milwaukee, Wisconsin	12.00	10.00
Curtiss-Parks Airport, E. St. Louis, Illinois	10.00	10.00
Aviation Enterprises, Ltd., Houston, Texas	10.00	10.00
Aero Enterprises, Inc., Denver, Colorado	9.90	6.90
Stewart Airport Company, Parkersburg, W. Va.	9.00	7.00
Northwest Aviation Corp., St. Paul, Minnesota	9.00	6.00

Lightplane rates for solo and dual time at 44 airports in three west coast states—California, Oregon and Washington:

	High	Low	Most Prevalent Rates
Solo	$9.00	$5.00	$8 at 14 airports
			$7 at 10 airports
			$6 at 7 airports
Dual	$12.00	$8.00	$10 at 13 airports
			$9 at 6 airports
			$8 at 6 airports

In the same area, of 33 airports reported, hangar rentals were as follows:

	High	Low	Most Prevalent Rates
Per day or night	$1.50	$0.50	$1 at 10 airports
Per month	$25.00	$6.00	$15 at 12 airports

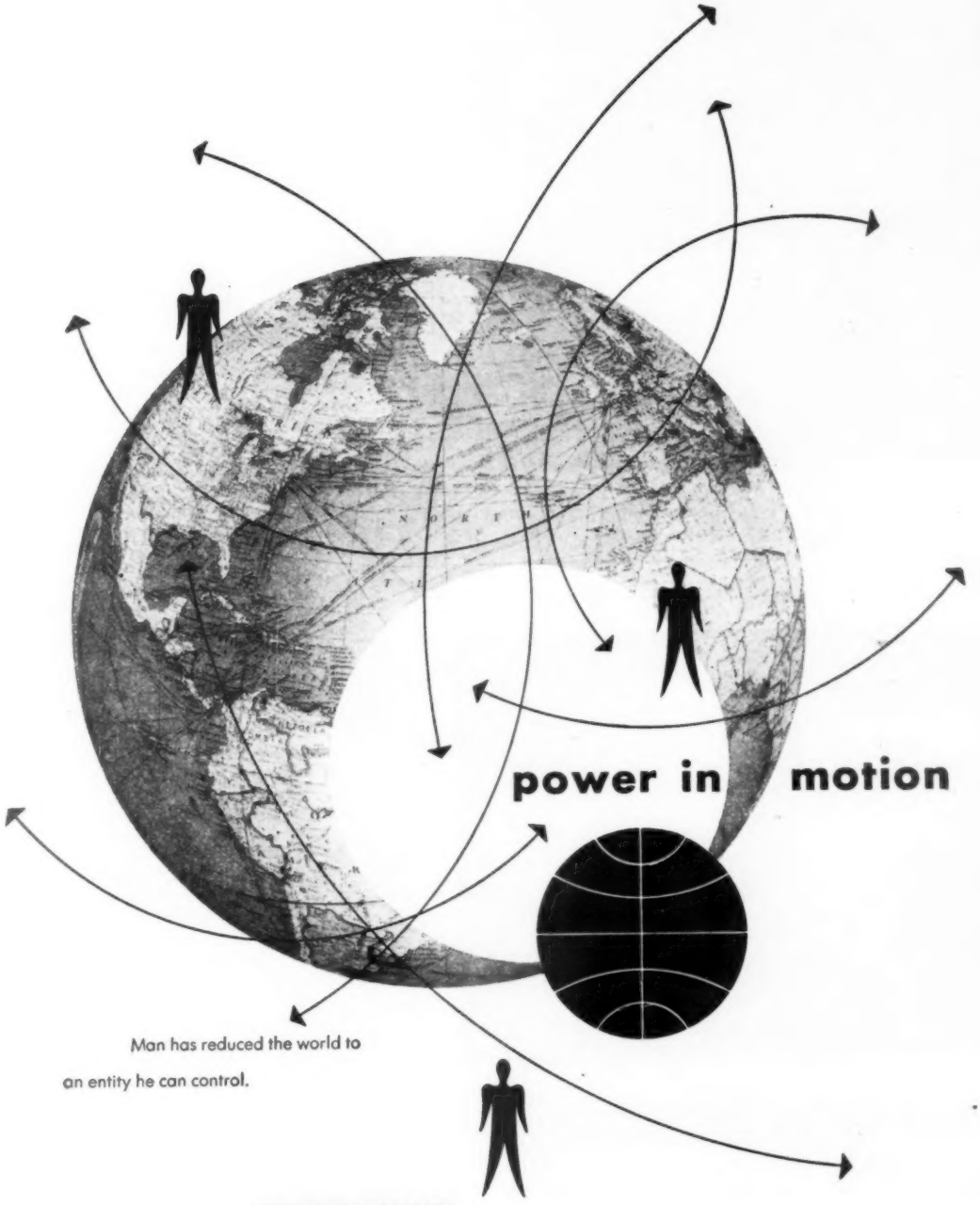
The AOPA survey also showed that 70 per cent of the airports reviewed had poor service, 28 per cent were considered to offer "good service" and two per cent "excellent service."

A new manifestation of The Bite has appeared in connection with solo and dual rates. This is in the form of an added flying-time charge of from 25 to 40 cents an hour for "insurance." "Buy this insurance," urges the operator, "and if you crack up the plane its owner will not be able to sue you for damages."

AOPA, which has gone into this situation with insurance experts, reports:

"This is false representation and the worst kind of business practice. Pilots should demand to see the operator's insurance policy. If he has one, the odds are that it will cover both plane and pilot. Operators who take on students pay the same hull rate regardless of whether they rent to solo pilots and the extra charge to the pilot is therefore unjustified unless a similar charge is made for student pilots flying solo. To say that the pilot will be protected from suit is also false if the operator holds insurance, because it is illegal for him to speak for the insurance company, which has the right to check on claims and take them to court if not satisfied."

It should be added that such tactics as



Man has reduced the world to
an entity he can control.

menasco
MANUFACTURING COMPANY
power-hydraulics

this is
NO TIME FOR
A TRIAL BALLOON

There's no need to buy pencils of undetermined origin when you can use the pencils that have already made their mark.

For many years, the KOH-I-NOOR Pencil Factory has been producing pencils uniformly graded in smoothly finished straight grained cedar.

TRY A KOH-I-NOOR TODAY
THERE ARE NO "STRINGS" ATTACHED

Send for Leaflet No. 17
KOH-I-NOOR PENCIL COMPANY, INC.
BLOOMSBURY, NEW JERSEY

Remember this button...

It means that the wearer has received an honorable discharge from the Armed forces of our country. To recognize this emblem, and to give the wearer the respect and consideration which is his due, is our first consideration.

ZIFF-DAVIS PUBLISHING COMPANY

The Bite for insurance money are neither prevalent nor long-lived, and are regarded with equal disgust by both good operators and lightplane pilots.

It is difficult to estimate accurately how much damage The Bite is doing to post-war private flying but here are comments from some of the victims:

The west coast man-and-wife team have sold their plane.

"Are you unsold on flying?" they were asked.

The husband replied for both with an emphatic "no!" adding drily:

"I'm even selling it to my friends. I'm telling my friends that it is the greatest sport in the world—for millionaires."

Says the Wisconsin $975 victim:

"Flying isn't going to progress if so much crookedness is connected with owning a plane, and something must be done to protect plane owners from the get-rich-quick guys."

Commenting on an $8-per-hour lightplane solo rate, one pilot writes from the West Coast:

"I believe this is out of bounds, if operators are interested at all in solo students and private pilots keeping on with flying."

He also comments on a $6 rate at a field in the east where he formerly flew: "The operator has a waiting list every flying day for his planes."

As for the $8-per-hour operator, "his airplanes can rot before I rent another one, and I know about a dozen pilots who feel the same way. I'm quitting flying until the prices come down or until I can buy a small lightplane of my own. Why in hell don't these chiselers wake up and realize they are only cutting their own throats?"

The victim of the $1,270 rebuild, puzzling over the lightplane situation, "can remember the day when Wacos, Fleets, and others" rented for what some operators are charging for lightplanes today. "I thought the lightplane was developed to make flying available to all, and not to make a few operators rich," he adds. "Can the private pilot afford to own a plane? I make $300 a month and I am about to sell my plane because I cannot afford to fly it. I have been flying since 1929 and a good part of the time I owned my ship although I made far less salary at that time than I do now. I could afford to fly then. It takes more than cheap airplanes to make flying popular. Doesn't it also take cheap maintenance and a square deal from the operators?"

Another middlewesterner draws on history, pointing out that a recent survey by Bruce Uthus, CAA director of manpower and training, showed that lightplane operational costs in 1940 were $2.76½ per hour, including gas, oil, labor, parts, maintenance, reserve for depreciation and overhaul, hangar rental and insurance. Not included was the plane's share of other fixed-base costs.

"But double the basic 1940 costs and add on for inflated prices today and you can come to only one conclusion," this pilot says: "Most flight charges are picking the pilots clean."

Operators, on the other hand, reply that they are doing the best they can and that the rates they charge are set with a clear conscience and can be defended with logic. Typical is the operator who charged the $8-per-hour solo rate objected to above, who replied hotly when it was suggested that he come down to $6. His per-hour net on rented planes, he points out, is only 85 cents an hour. And he is a man who has been in business more than a decade, who has matched notes with fellow operators in all parts of the country, and states flatly: "I don't know anybody who's getting rich on flying time."

Plane manufacturers, torn between an acute consciousness of this view and a desire to see as many people fly as possible, are equally cautious about supporting a move toward lower rates. They fear that if they do they will lose their best salesmen, the fixed base operators, and they assert that it is impossible to standardize rates on a nation-wide basis. Over-all airport operating costs, shipping charges for equipment to distant fields from the factories, and salary differences, among other factors, vary too widely to standardize even in a given state, much less the entire country. This is the concensus not only of interviews with individual manufacturers but of the Aircraft Industries Association of America, formerly the Aeronautical Chamber of Commerce, representing all of them.

Are rates, then, going to continue high? Will—as a recent CAA survey warned—costs be so prohibitive to the average

flyer that the era of the 'thirties will return—an era in which one-third of those buying planes sold them in a year or less, half sold them in less than two years, the mean period for 80 per cent of the owners was less than two and a half years, and only 15 per cent of those taking flying lessons went even so far as to get a private license? Is the high cost of pleasure flying going to kill the golden enthusiasm of thousands of potential flyers?

A chorus of "no!" comes from manufacturers, operators, and pilots alike. Manufacturers and operators point out that as airplanes become more numerous there will be opportunities to serve more customers at less cost, with a corresponding lowering of charges. New planes will operate more efficiently, consume less gas and oil per mile, will break down less often, will be less expensive to repair. Again, savings will be passed on to the consumer. Prices at present are inflated; if and or when costs generally diminish, operators and pilots alike will benefit.

AOPA, speaking for the flyers, replies that all this may be true but to delay disciplining flagrant offenders among the operators is to court disaster.

"We are telling all our plane owners to demand estimates for overhauls in writing and to pay no questionable bills without demanding a thorough accounting," said one spokesman for the organization.

"Under present conditions," says Laurence P. Sharples, AOPA president, "aviation is threatened with losing sportsmen pilots faster than new ones are added. Worse, those who quit change from crusaders for flying to bitter campaigners warning away recruits. For the good of the industry, the operators, and aviation generally, something must be done and done immediately."

AOPA has followed up this policy with action. The surveys reviewed in this article are one result. They are implemented by two cards, addressed to the association's headquarters, with postage prepaid. The first card is a fill-in report on the conditions at any given airport. Space is provided for an excellent-good-or-poor rating for such facilities and characteristics as landing area, neatness, cleanliness, safety provisions, repair services, gas and oil, hangars, courtesy, transportation to nearest town with rates, and restaurant facilities if any.

The second card—more concerned with The Bite—leaves blanks for solo and dual rental fees per hour, cost of hangar space, and maintenance facilities.

AOPA pilots are urged to "carry a supply of these in your plane and send them to AOPA regularly," and Washington headquarters has received such an excellent response that complete national coverage is anticipated by late spring.

The card reports are being used for a dual purpose. Pilots in the association may get an airport's rating from national headquarters. And national headquarters, once a concensus is received on a given port, writes to the field's manager, tells him frankly what the customers think of his operation and that he will be informed of any changes in his status made possible by future reports.

AOPA believes that the long-term

Advertisement

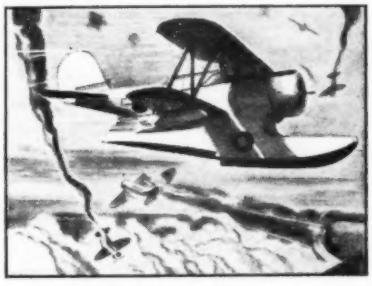
AMPHIBIOUS GO-GETTER

Doughty Duck

Not generally known is the fact that aircraft carriers as well as cruisers commonly carry one or more stocky biplanes with sea-going hulls and retractable wheels. These same odd little planes are also to be seen on many a coral strip in the far Pacific. They are "Ducks" and they did a unique job in the war.

While fighter planes are lightning-fast and bombers are designed for load and range, the Columbia Duck was built (1) to go where other planes can't and (2) to "take it." Amply fulfilling these requirements and more, the Duck soon became the plane of all-work, in the Navy, Marines and Coast Guard.

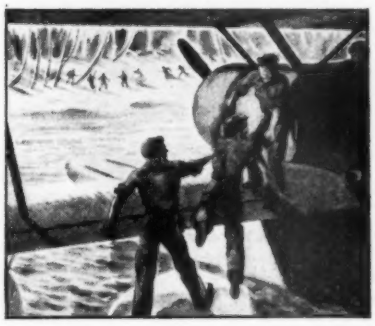
Rescue a fighter pilot from Jap waters? Call a Duck. Rush blood plasma to an island outpost? Call a Duck. Bring the mail to a carrier at sea? Rou-



tine for the Duck. No wonder the Duck made firm friends throughout the far-flung fronts of the air-sea-land war!

Charmed Life

Despite the commonly hazardous nature of the Ducks' duties, their safety record was astonishingly high. These sturdy planes seemed almost to lead a charmed life. On one occasion, an admiral went out in a Duck to check for himself on some enemy positions. On the way back, he and his pilot suddenly found themselves in the middle of a dog fight, with Japs falling at right and left. The admiral borrowed the pilot's rifle, but the otherwise unarmed Duck sailed through without attracting a shot.

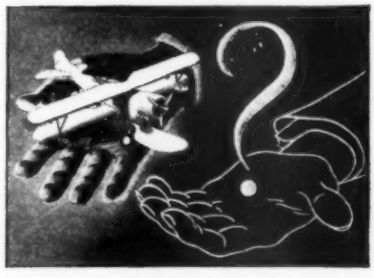


Rescue

One Navy lieutenant, whose destroyer was sunk by a torpedo, drifted thirteen days on a float and finally made shore on Arundel Island, in the South Pacific. Dodging Jap patrols for four additional weeks, he was found by a Duck. The pilot waved, the Duck circled, hit the water and skidded to a stop. With the castaway aboard, it took off just as an enemy patrol came down the beach.

New & Bigger Version

Through the war, Columbia Aircraft workers met demands for "more Ducks" with ever-increasing production. Not a single delivery date went by unfulfilled. Now these same skilled craftsmen are building a new and larger monoplane amphibion, with much greater load capacity and range. Like its predecessor,



the new plane is a ship of all work, homing on sea or land—with exceptional ruggedness built-in. Inquiries are now invited about the commercial and industrial uses of this new aircraft.

Columbia Aircraft Corporation,
Valley Stream, N. Y.

effect of the cards will have an affirmative value, giving credit to good airport operations and encouraging pilots to patronize them.

That the program will eliminate The Bite is too sanguine a hope, AOPA officials believe, but they feel that it will go a long way toward controlling it and speeding the day when aviation costs to the private pilot will be more reasonable.

"Our ultimate goal in aviation should be to put the lightplane within the financial reach of newsboys and baby-sitters," says Sharples. "If their opportunity to fly cannot be measured in terms of pennies, then the lightplane industry must face the bitter fact that its future will not be measured in terms of the large dollar volume that is the favorite topic of the prophets." END

Maneuvering in Safety

(*Continued from page 49*)

not be subjected to more acceleration than it is designed for, since a high speed stall will occur before this can happen. On the other hand, if the airplane has complete elevator control and the pilot attempts a high speed stall at 120 m.p.h., the airplane will experience a 4.56-G acceleration (Figure 2). Since this is considerably over the design 3.47-G, the airplane probably will be structurally damaged.

Since the maximum G that the pilot can safely put on during any maneuver is 3.47, and this occurs automatically when the plane is stalled at 108 m.p.h., 108 m.p.h. is, therefore, the maximum "safe maneuvering speed." The breakdown of the flight envelope into the "safe maneuvering airspeed range" and the "limited maneuvering airspeed range" is shown in Figure 3.

The flight envelopes illustrate the derivation of the safe maneuvering speed for the particular aircraft of Table 1, which was used as an example. To avoid the necessity of compiling a flight envelope for every aircraft in the 1,000 to 2,500 pound weight class, a compound graph is presented in Figure 3. From this graph the safe maneuvering airspeed for *any* airplane can be read off directly, knowing only the gross weight, gross wing area and power loading. This data is usually included in the manufacturer's handbook for his particular aircraft.

The graphs of Figure 1 are compiled as follows:

Graph A: is a plot of the variation of wing loading, W/S, with gross wing area, S, and gross weight, W. The gross wing area is the wing area including the fuselage. The wing loading is the gross weight (pounds) divided by the gross wing area (square feet).

Graph B: shows the variation of the indicated flaps up stalling speed, V_s, with wing loading, W/S. This stalling speed is the airspeed indicator reading after correction for the position error of the airspeed pitot head. To make this curve applicable to all aircraft a maximum lift co-efficient of 1.5 has been assumed and the stalling speed is then calculated from the standard relationship:

$$V_s = 16.15 \sqrt{W/S} \text{ m.p.h.}$$

Graph C: illustrates the CAB's requirements for the minimum design acceleration, in terms of G, for any aircraft with gross weight, W, and power loading W/P. The power loading is the gross weight (pounds) divided by the rated engine power (horsepower);

Graph D: is the safe maneuvering airspeed, V_a, for any stalling speed, V_s, and any design acceleration, G.

By reading from Graph A through Graph D of the safe maneuvering airspeed for any aircraft can be ascertained. This speed, as read off Graph D, is actually the *indicated* airspeed without correction for the position error of the pitot head. If the position error is known, for the particular aircraft considered, the safe maneuvering speed should be corrected accordingly to give the actual airspeed indicator reading. For many airplanes, however, the position error at these speeds is usually small and if it is

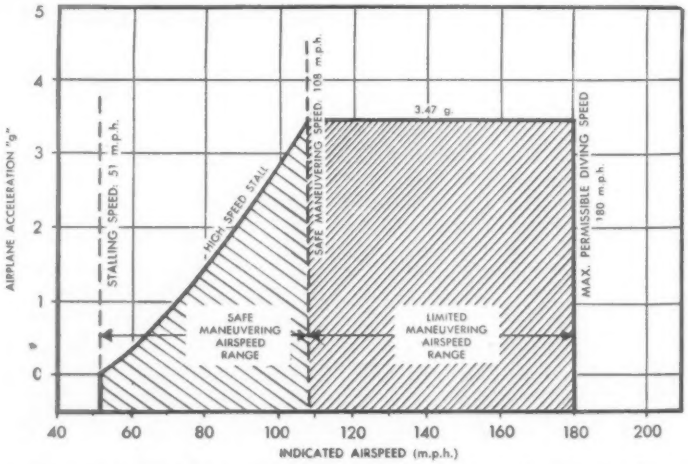
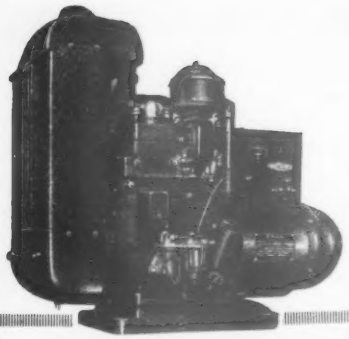


Figure 3 charts the safe and limited maneuvering airspeed ranges for the class of aircraft that would have characteristics listed in table, page 49.



ELECTRICITY
To Meet Aviation and Aircraft Industry Power Needs

ONAN ELECTRIC GENERATING PLANTS provide power for many applications in the aviation industry. Available in 65 models including Airborne, lightweight, compact types. Powered by Onan-built gasoline engines, they are of compact, single-unit design. For heavy duty service, stationary or mobile.

Models range from 350 to 35,000 watts. A.C. types from 115 to 660 volts; 50, 60, 180 cycles, single or three-phase; 400, 500 and 800 cycle, single phase; also special frequencies. D.C. types range from 6 to 4000 volts. Dual voltage types available. Write for engineering assistance or detailed literature.

Model shown is from W2C series.

ELECTRIC PLANTS Onan POWER AND LIGHT FOR EVERY NEED

D. W. ONAN & SONS
2199 Royalston Ave.
Minneapolis 5, Minn.

RIDE A NEW HARLEY-DAVIDSON

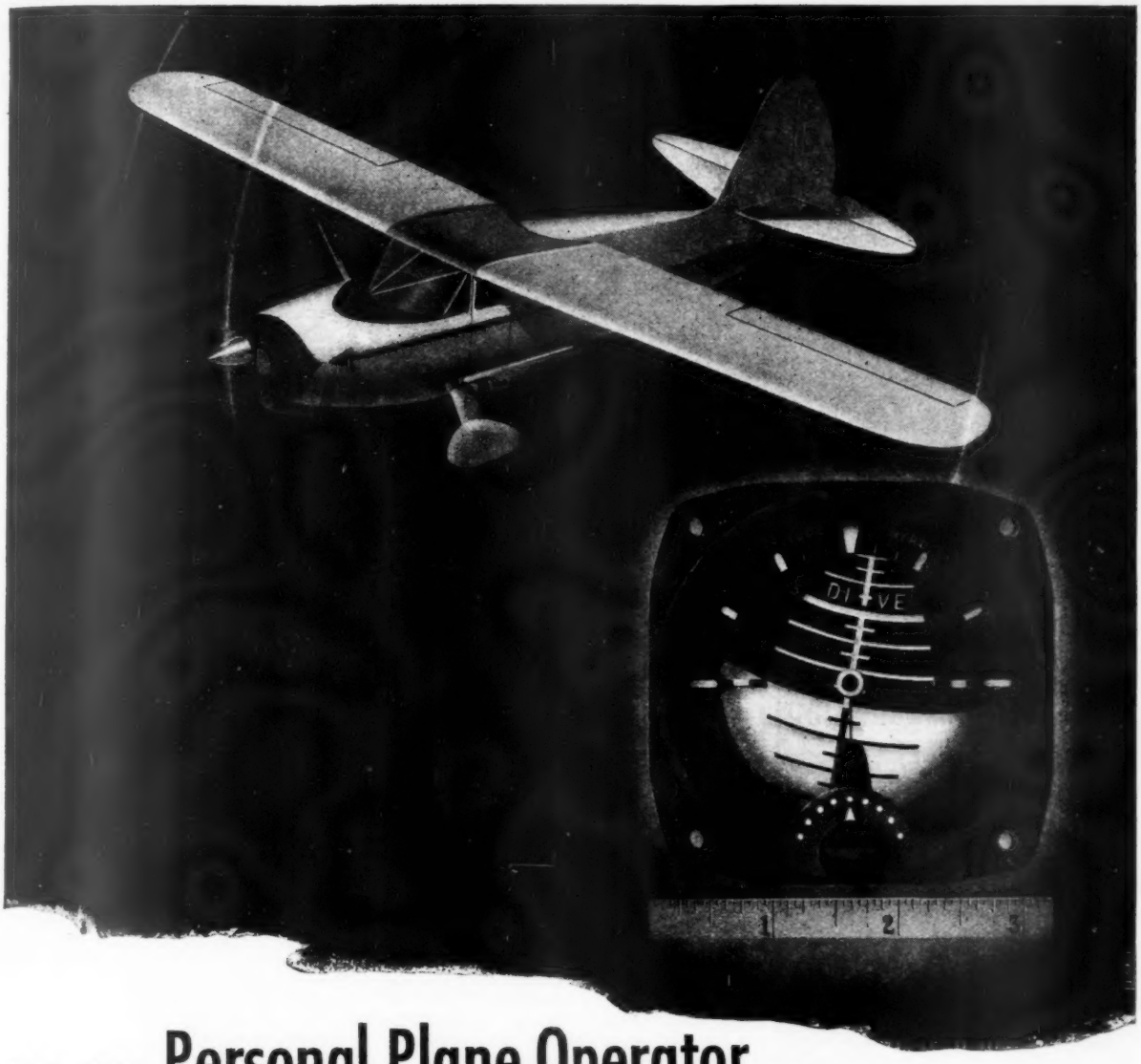
HAPPY TOURING AND FUN DAYS AHEAD!

The new Harley-Davidsons are rolling off the production line — ready to thrill more and more riders who want the power, rugged dependability, and proved performance of the "World's Champion Motorcycles." Get set for fullest enjoyment of glorious, fun-packed days ahead—as you ride your own Harley-Davidson on pleasure-filled tours and exciting endurance runs, or take in race meets, hillclimbs and other motorcycling good times. See your Harley-Davidson dealer EARLY!

HARLEY-DAVIDSON MOTOR CO.
Department F Milwaukee 1, Wis.

Write for free copy of ENTHUSIAST MAGAZINE filled with motorcycling pictures and stories.

HARLEY-DAVIDSON MOTORCYCLES



FOR THE Personal Plane Operator...

AN IMPORTANT NEW PRIMARY INSTRUMENT

An air driven Attitude Gyro, built under the same high standards as the well-known Sperry Directional Gyro and Gyro-Horizon, has been developed by Sperry Research and is now available. This instrument can be used on any airplane where vacuum operated instruments are normally required.

The same "Four Freedoms in Flight" which Sperry's electric Attitude Gyro is giving to pilots of military and transport aircraft—freedom from caging, tumbling, misinterpretation, fatigue—are now at the fingertips of the personal plane operator.

Pattern indication (the same by day or night) gives the pilot a quick, visual picture of his attitude at all times...continuously, at any flight angle, regardless of visibility or turbulence.

Sperry's Model F-3 Attitude Gyro is of small standard size, light weight (2¼ lbs.) and low initial cost. Its simplicity of construction means reduced maintenance cost.

Write our Aeronautical Department for further information.

SPERRY GYROSCOPE COMPANY, INC. GREAT NECK, N. Y.

Division of the Sperry Corporation

LOS ANGELES • SAN FRANCISCO • SEATTLE • NEW ORLEANS
CLEVELAND • BROOKLYN • HONOLULU

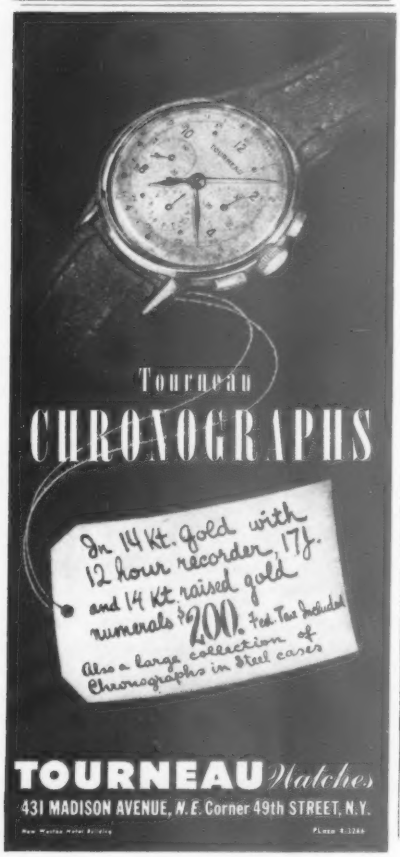
GYROSCOPICS • ELECTRONICS • RADAR • AUTOMATIC COMPUTATION • SERVO-MECHANISMS

Municipal Airport, No. 2
Jacksonville, Florida
NOW OPEN TO PRIVATE PILOTS

Jacksonville's Municipal Airport No. 2, Craig Field, is now open to civilian flying. All service facilities are available. A 24-hour guard is maintained.

Jacksonville invites you to include Craig Field in your next itinerary, whether as a stop for gas and oil or for a prolonged visit.

City of Jacksonville FLORIDA


Tourneau
CHRONOGRAPHS
In 14 Kt. Gold with 12 hour recorder, 17 J. and 14 Kt. raised gold numerals $200. Fed. Tax Included
Also a large collection of Chronographs in Steel cases
TOURNEAU Watches
431 MADISON AVENUE, N.E. Corner 49th STREET, N.Y.

not noted in the aircraft manufacturer's handbook it can be neglected.

To illustrate the use of Figure 1, the aircraft with the characteristics shown in the table will be used, although any other airplane would be equally suitable. The solution for the safe maneuvering speed, from Figure 1, is as follows when the only data given is Gross Weight, 1,600 pounds, Gross Wing Area, 160 square feet, and Power Loading, 17.8 pounds per horsepower:

Graph A: from Gross Weight = 1600 lb. (given) and Gross Wing = 160 sq. ft., (given), read Wing Loading = 10.0 lb. per sq. ft.;

Graph B: with Wing Loading = 10.0 lb. per sq. ft. (from Graph A), read Stalling Speed = 51 m.p.h.;

Graph C: with Gross Weight = 1600 lb. (given) and Power Loading = 17.8 lb. per h.p., (given), read Design Acceleration = 3.47G;

Graph D: with Stalling Speed = 51 m.p.h (from Graph B) and Design Acceleration = 3.47G (from Graph C), read Safe Maneuvering Speed = 108 m.p.h.

Although, in this particular example, the values of wing loading, stalling speed and design acceleration were read off from the individual graphs of Figure 1, in actual practice this is not necessary. By merely proceeding mechanically from Graph A through Graph D, the safe maneuvering speed can be obtained without recording the intermediate readings.

Once the safe maneuvering speed has been estimated it is advisable to mark the airspeed indicator of the aircraft some 10 per cent lower to allow a margin of safety in maneuvering and to take care of air density variations from standard. With the safe maneuvering speed permanently recorded and kept in mind, we may help to lower the structural accident rate and look forward to safer flying than has existed in the past. END

Super Airport

(*Continued from page 26*)

Idlewild's area of seven square miles is roughly eight times that of LaGuardia Field, itself no inconsequential airport. Yet where LaGuardia Field was obsolete and outgrown almost upon completion, Idlewild is being designed and constructed to allow for expansion and revision to keep ahead of or abreast of air transportation.

Idlewild thinking suggests that the ability to move people and goods between New York and London in 15 hours, Buenos Aires in 27, Calcutta in 39, Sydney in 49 is likely to produce rather drastic changes in habits of thought, in methods of doing business, in travel, in life itself. With air travel rates below those of Pullman rail fare in the United States and possibly as low as $148 to London, $152 to Paris, $161 to Berlin, $176 to Moscow, and $209 to Cairo, international travel by plane is likely to become commonplace.

Idlewild psychology is that the country's great distances are in line for an enormous shrinking process. The possibility of transforming American raw materials at their sources into finished products air-delivered overnight to retail outlets stocked only with samples is taken as representing merely one grossly simplified example of revolutionary changes to be expected in domestic manufacture, distribution, and trade.

Within 10 hours of New York are all the productive facilities of North America, Central America, the Caribbean, and half of South America. Edibles can be delivered to New York from virtually any point in the United States in about the same time it now takes to truck fresh vegetables from South Jersey to Bronx City Market. Thus, economically, New York City will be a swinging door to the world's great markets. Long Island potatoes and New Jersey tomatoes can travel out in the same planes which bring in Florida grapefruit and California oranges.

All of the construction, planning and operations of this great undertaking are the responsibility and under the supervision of Commissioner John McKenzie of the City Department of Marine and Aviation. The consulting engineer in charge of design and construction is Jay Downer. The airport's traffic connection with the city's parkway and expressway system is under the watchful eye of Commissioner Robert Moses, City Planner. Delano & Aldrich are the architects for the buildings. Maj. Elmer Haslett, director of airports, is a key figure in this able team. City Comptroller Joseph McGoldrick is handling the financing. Co-operating are representatives of 12 airlines which have already signed leases for airport space: American, American Airlines Overseas, Eastern, National, Northwest, Pan American, PCA, TWA, United, British Overseas Airways, Swedish Intercontinental, and Trans-Canada.

When I took over New York City's administration in 1934 I found the world's largest metropolis in a messy condition. I had to de-louse it and get it out of hock. I found, among other things, an airport with no planes—Floyd Bennett Field. I took an option on North Beach despite much opposition from politicians.

At that time the airlines were operating from the mud flats of Newark. Airline people are nice folks but they don't like to pay rent. There's an analogy I'd like to cite. When you move ill-clothed, ill-fed, ill-housed people from tenements to a new housing development they become new people. They become happy, well-fed, ambitious and prosperous. Likewise, when we moved the airlines from their primitive quarters to LaGuardia Field, they became respectable. Now they are co-operating fully with our Idlewild project.

The exact site of Idlewild is 16 miles from Grand Central Terminal along Jamaica Bay. Most of the land was vacant but there is a smoke stack and an oil tank rising above the 40:1 instrument approach ratio 1½ miles from the field. Eventually they will be lowered to maintain an ideal, unobstructed approach zone for two miles. Open approaches exist

Soon . . . in your town . . . on your airport . . . there will be a *new sign* of fine aircraft service.

Where you see it displayed it means a million-dollar inventory in parts and supplies and the country's finest overhaul and maintenance facilities are behind that dealer — at your command for the best in aircraft service.

Service Operators: Write now for the details of the Pacific Airmotive Authorized Dealer Plan. You will be able to serve your customers better and faster with aviation's largest and oldest service and supply organization behind you..and with a minimum investment for inventory and facilities. Write today.

PAC

PACIFIC AIRMOTIVE *corporation*

BURBANK	OAKLAND	SAN JOSE	GLENDALE	SAN DIEGO	KANSAS CITY	SEATTLE	ANCHORAGE
Lockheed Air Terminal	Oakland Airport	Pacific Airmotive Airport	6265 San Fernando Rd.	544 7th Avenue	1628 McGee Street	P. O. Box 272 Kent	Alaska

AVIATION SALESMEN

ARE NEEDED NOW

Profit from your experience as a military pilot, air force or civilian mechanic, commercial or private pilot or engineer. Turn this valuable knowledge into a real income. With its war job completed, Aviation's greatest need is for *trained salesmen.*

Even if you are in the armed forces, you can study in your spare time the basic principles and techniques that underlie all successful aviation selling. Stimulating for experienced personnel and informative for new salesmen. Endorsed by commercial aviation leaders . . . written by designers of sales training programs for the industry.

Write for Free Booklet.

AVIATION INSTITUTE
OF PROFESSIONAL SALES TRAINING
A Division of Aviation Associates
664 N. Michigan • Chicago 11, Illinois

INTRODUCING-New Victory Model HANDIWELD ELECTRIC ARC WELDER

FULLY GUARANTEED

RETAILS ONLY $1.95

PLUGS into LIGHT SOCKET

Victory Model Handiweld Arc Welder operates from 110 volts A. C. or D. C. current same as other arc welders higher priced —generates tremendous heat to weld all metals. Not a toy welder that uses carbons, but actually uses standard coated rods . . . sizes 1/16" and 3/32". Generous quantity of 1/16" and 3/32" rods supplied with the welder. Guaranteed not to burn out. Repairs fenders, radiators, auto bodies, machinery parts, etc. Take Victory Model Handiweld anywhere to job, operate right from light socket. You'll find a thousand uses for this welder around your home, garage, workshop. Also in garages, factories, repair shops, tinshops; mechanics, inventors, plumbers, farmers, etc.

SEND NO MONEY We'll rush one to you with rods, helmet, operating instructions, and all necessary parts with the exception of a large jar and a small piece of extension cord; these most everyone has. Pay postman only $1.95 plus a few cents postage. If not delighted return Victory Model Handiweld in 5 days from receipt and money paid for it will be refunded to you promptly. Rush your order for a "Victory Model" Handiweld today!

KUMFY PRODUCTS, Dept. D-234 CINCINNATI 26, OHIO

MINIATURE AERIAL BOMB CIGARETTE BOX Richly finished in natural hardwood. Perfect symbol of America's peace-making might, and of war's end. $2.49

The Ai-Dee III Low Priced Aerial Pack Camera for private flyers. Write for literature. $19.95

Aero Devices
5134 West Madison St., Chicago 44, Illinois

now from the south, southeast and southwest.

Jay Downer and his engineers found a deep underlying sand covered by marsh meadow mat and silt four to six feet deep and eight feet deep in some old creek beds. Ten feet of sand fill was pumped in hydraulically. This became stabilized in four months and after two years of observation no mud waves have been visible. The fill, which is sharp sand dredged from the bay, will finally total 41,000,000 cubic yards—the largest single fill operation in history. And by so doing a seaplane landing area 1,750 feet wide and 13,000 feet long is available.

The runways, paved with 12-inch, high-grade concrete, will vary between 1½ and two miles in length. They will be able to withstand loads up to 150 tons, at 75,000 pounds per wheel. An unprecedented number of taxiways—six miles in all—will be 100 feet wide and carry 14 inches of concrete. This will greatly add to the value of our nine miles of runways, which will be 200 feet in width. The loading apron around the circular administration building will be 800 feet wide and will have 35 loading stations.

One of the most important problems was that of drainage, for the entire area is practically level. Weekly readings were taken for 21 months. They disclosed that the ground water table was extremely sensitive to rainfall, rising up to 18 inches after a heavy rainstorm. Thus, it was decided to install a positive system for runways, taxiways and the apron area to assure removal of a large percentage of the rainfall from the sub-soil.

A record tide during the September, 1938, hurricane was at an elevation of plus 9.63. The crown grades of all runways therefore have been placed at plus 14, excepting two at plus 14.5. Runways and taxiways including 50-foot shoulders for the former and 30-foot shoulders for the latter, will have transverse grades of one per cent in either direction from the crown. The outer portion of these shoulders, made of stabilized material, will have a shallow gutter with drop inlets at intervals of not more than 400 feet. The apron will be drained by rows of continuous scuppers, discharging into 23 trunk sewers. The sewers will empty into drainage canals on the east and west sides of the field into the bay to the south. The drains will total 28½ miles; concrete for all purposes will total 4,700,000 square yards and cement will total 2,500,000 barrels.

At the center of the pinwheel of runways and surrounded by a commodious loading apron will be the $10,000,000 administration and control building containing more than 1,000,000 square feet of floor area. This building will be flanked by a serpentine loading building with an observation platform roof and 90 traffic gates. Beneath bridges connecting administration and loading building will be roadways serving all traffic gates and permitting airline busses to discharge passengers at the proper gates.

Plans for the administration and control building have been changed more than 100 times since they were started by Delano & Aldrich and are likely to be changed again. Currently they provide for inclusion of a control tower, the design of which is being determined by developments in radar; offices, waiting rooms, and other accommodations. These include restaurants, motion pictures, theater, bars, communications offices, branch banks, flower and candy shops, drug stores, barber shops, haberdasheries and a small assembly hall.

Underneath the building will be roadways and passageways for motor trucks and busses, passenger cars and delivery trucks, taxis, lift trucks, trailers and mechanical carriers for baggage and merchandise. Design here is highly flexible because of continuing progress in developing mechanical devices and conveyors for expeditious handling of air-cargo merchandise. Much remains to be done in providing time-saving equipment. Minutes lost in grounded airplane time can disturb flying schedules.

Service facilities outside the administration building will include about 40 hangars, repair shops, freight and express depots. In fact, Idlewild in itself will be a city of 40,000 people in a decade, having its own fire and police departments, parking facilities for 30,000 automobiles, a tank farm for storage of fuels and lubricants in volume.

The tangential design, with runways making the pattern of a gigantic pinwheel, is the latest in airport planning. Paralleling runways will be more than a mile apart so that planes can maintain schedules whether landing by contact or by instrument—regardless of traffic, wind, fog, hail, snow or zero ceilings. Three planes can land and three can take off simultaneously and safely on six runways. Further development of instrumentation and radar are expected to make possible take-offs and landings at 60-second intervals on opposite runways. Thus movements of 240 to 360 hourly.

Accessibility to centers of business and population, lack of which handicaps so many municipal airports, is being assured in various ways. The present motoring time of 35 minutes from the air terminal building on 42nd Street is to be reduced to 25 minutes by construction of approach highways, notably the six-lane Van Wyck Boulevard. This will connect with Queens Boulevard and a new Mid-Town Highway leading to the 38th Street tunnel and to Queensborough Bridge. Southern Parkway will pour motor traffic to Belt Parkway, which connects with Battery Tunnel for a direct route to downtown New York. Parkway connections with four boroughs, a rail service to and from the Long Island Railroad's Howard Beach Station, and even seaplane and helicopter aerial ferries are in the picture of convenient local transportation.

As you may have judged by now, the Idlewild Airport is a costly undertaking. Yet it will be one of the best investments the city ever made. It will pay for itself; the taxpayers will not have to pay for it. I stake my reputation for prudent administration of public affairs on that.

The airport represents an investment of $91,700,000 by New York City, $66,000,000 by the airlines for hangars, $16,000,000 by the airlines for the arcade. About

1950, in the final construction stages, the annual charges to New York City will be $5,488,055. This breaks down into $858,055 in lieu of taxes, $2,618,000 for interest and amortization of bonds, $2,012,000 for annual operations and maintenance. Comptroller McGoldrick expects a Federal grant of $25,000,000 which, if granted, will reduce annual charges to $4,396,350, while revenues by 1954 will be $4,356,100. The $9,000,000 received from the Navy for Floyd Bennett Field paid for Idlewild's land.

By this time first stages in Idlewild construction should be completed, that consisting of three main runways and a $125,000 temporary administration building to last two years.

The second stage should be finished in 1947. The airport then will have its six principal runways, complete taxiway system and the permanent administration building, hangars, and other necessary facilities.

We were ready to commence operation on December 1 . . . three enormous runways were completed. A temporary administration building, 300 feet long costing in the neighborhood of $200,000, was 98 percent completed. The approach road to the field was completed, the planting for the protection of the present runway was completed . . . yet we could not operate . . . because of a labor controversy between an independent union of the telephone company and the electricians and the building trades employees over who has the right to pull the telephone wires. We have had a controversy between the plumbers and the employees of the excavators union about who would excavate 400 feet of ground.

The third stage will be on its way, according to present plans, by 1950. The total of 12 runways with increased operating facilities will be available. The ultimate runway pattern is based on actual knowledge and proved experience, and will fit the first six runways built. The design of these third stage runways will develop in accordance with the growth of traffic and improvement in landing art. Along with great improvement in landing equipment, constant perfecting of navigation instruments and greater safety in bad weather landing, much greater capacity will be obtained from airports.

The Board of Estimate, the City Council, and the City Planning Commission have given splendid co-operation. Without it we could not have taken the lead once again in developing adequate metropolitan facilities for air transportation worthy of the city of New York and calculated to insure its continued pre-eminence in the field of commerce. END

Report From Washington

(*Continued from page 43*)

William B. Stout, conference chairman, called for an airplane "to fit the needs of the public, not aviation people," and said "such a plane is not even in sight." He also disclosed that a new glass fiber unaffected by temperature or weather and one-quarter the weight of steel is being developed in plate form for airplane structures. Attempts are being made to mold the fiber in one operation into wing sections that would weigh less than one pound per square foot and cost about $1 per square foot. A personal plane made of such material, he said, should not weigh more than 650 pounds and, with the proper engine, should not cost more than $1,500. Stout also reported that there is now in operation a 100-h.p. engine adaptable for both automobiles and a two-place plane. It turns up slightly more than one h.p. per cubic inch displacement and should sell for $150. He also mentioned as already created, a slide-valve engine for airplanes.

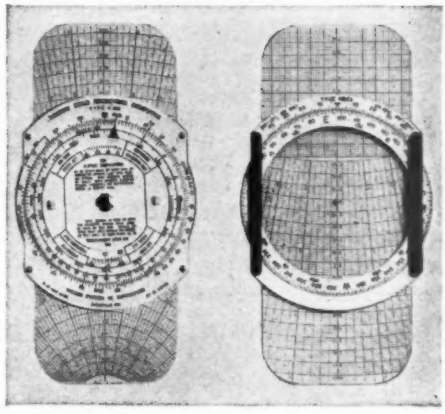
Jean Dubuque of Beechcraft announced plans for their new plane—all-metal, four-place, retractable tricycle gear, low-wing, 165-h.p. engine, flaps, and controllable pitch propeller—to sell for about $5,000.

Attendance at the two-day conference, sponsored by the Joint Aviation Users Conferences of NAA, was light, except at luncheons and dinners. Some representatives of the aviation press objected to paying $20 for the privilege of covering the numerous business sessions and speeches at the luncheons and dinners.

Fairchild F-24 Contract

The contract authorizing Texas Engineering & Manufacturing Co., Ltd., to build 250 Fairchild F-24, four-place monoplanes, was written after Fairchild officials had searched for

★ WEEMS ★
AERIAL NAVIGATION
★ INSTRUMENTS ★



DALTON E-6B COMPUTER

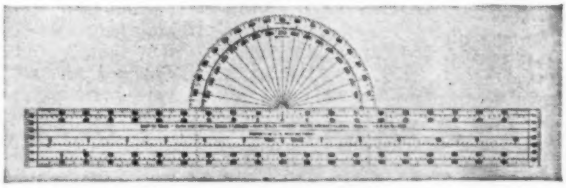
This is the original computer. Nothing else has been able to match it. Officially adopted by the Army and Navy Air Forces for use of pilots and navigators.

Here are some of the many uses: Vector Face — 1. To find the track and ground speed for a given heading and air speed. 2. To find the heading and ground speed for a given track and air speed. 3. To find the heading and air speed for a given track and ground speed. 4. To find the wind from drift measurements. 5. To find the wind from ground speed measurements.

Circular Slide Rule Face: 1. Fuel consumption calculations. 2. Time, speed, and distance calculations. 3. Altimeter corrections. 4. Air speed corrections. 5. Distance conversions (nautical-statute-kilometers).

Size 5 inches by 9½ inches. Complete with carrying case and 23-page instruction book $10

AIR NAVIGATION (406 pages). Covers charts, chart reading, compasses, air pilotage, Dead Reckoning equipment, theory and practice, instrument flying. $3.50



WEEMS AIRCRAFT PLOTTER—MARK II

This Plotter is the most popular on the market. It is standard with U.S. Army Air Forces and many commercial lines. Scales are 1:500,000, 1:1000,000. Here are some of the uses — Plotting courses, plotting bearings, measuring distances, plotting lines of position, constructing wind diagrams, substitute for parallel rulers, dividers, and protractor $2

Get Weems instruments and texts at any aviation supply store

☆ WRITE FOR 26-PAGE CATALOGUE ☆

AIR WSN WEEMS SEA SYSTEM OF NAVIGATION
ANNAPOLIS, MARYLAND

BUY THE ORIGINAL PRINTS
USED FOR CONSTRUCTION OF
THE KNIGHT TWISTER

A HIGH PERFORMANCE BIPLANE
150 m.p.h with 75 h.p., or 185 m.p.h. with 95 h.p.
Detailed Prints for $7.75
Set of 6 Pictures $1.00
To Drawing Purchasers An Airplane Design Course, Including a $2000 Stress Analysis of the Knight Twister for only $25.00. Send 25c Mailing Costs for Information.
VERNON W. PAYNE, Designer
5047 Miami St., St. LOUIS 9, MO.

Be Sure to Build Popular Cleveland These Models

36", P-61 BLACK WIDOW.
A C-D Industrial Training Model. C-D Kit T-155 ..... $1.50
Send 5c for Catalog

Mitchell B-25 Bomber
55". C-D Master Flying Model Kit SF-125 $8.50

Mustang P-51
Span 26 3/16". C-D MFM Kit SF-91. $3.00
See your dealer first. If he can't supply you, order direct, including 20c extra for packing-postage.
CLEVELAND MODEL & SUPPLY CO.
4508 Fl4 Lorain Ave. Cleveland 2, Ohio, U.S.A.

NEW TINY POCKET SIZE RADIO!
Slips in your pocket or purse —Wt. only 3 ozs.! Complete READY TO PLAY as shown with self contained phone for personal use. Beautiful black silver plastic case. Has patented fixed Crystal-Slide Tuning Dial! NO TUBES, BATTERIES OR ELECTRIC PLUG-IN REQUIRED. USUALLY RECEIVES LOCAL BROADCASTS without outside aerial wires.
GUARANTEED TO WORK when connected and used according to instructions or your money back. 10 day trial. Can be used in homes, offices, hotels, cabins, in bed after hours, etc.
SEND ONLY $1.00 (cash, money order, check) and pay postman $2.99 plus delivery fees on arrival or send $3.99 for postpaid delivery. IDEAL GIFT FOR CHILDREN OR ADULTS ALIKE! Get your PA-KETTE RADIO NOW for real enjoyment. Dealers in most cities.
PA-KETTE ELECTRIC CO., Dept. F-2, Kearney, Nebr.

STAMMER?
This new 128-page book, "Stammering, Its Cause and Correction," describes the Bogue Unit Method for scientific correction of stammering and stuttering—successful for 45 years. *Free—no obligation.*
GET THIS FREE BOOK!
Benjamin N. Bogue, Dept. 8263 Circle Tower, Indianapolis 4, Ind.

Learn modern watch and clock repairing
At home, spare time. Good field now . . . Security and contentment in future. Start part-time business and earn while you learn. HOROLOGY is precision instrument work . . . a great and growing field, sensational opportunities. Easy self-instruction course. Low price. Money-back guarantee. Write now for Free Success-Catalog.
NELSON CO.,
1139 So. Wabash, Dept. 2917, Chicago 5

LAWRENCE FLYING CLOTHING
Immediate Delivery. Shipped Prepaid
A-2 Army horsehide Flight Jackets with full length zipper $19.95
B-3 Regulation Army Pilot Jacket (Sheepskin). 32.95
B-2 Army Acrolyte Sheepskin Flight Cap with ear flaps, leather visor 3.75
STATE SIZE
423 S. Plymouth Ct., Dept. F, Chicago 5, Ill.

plant facilities to house their new Personal Plane Division. With all floor space at Hagerstown, Md., devoted to production of the *Packet* (C-82) and to military experimental work, Fairchild swung over to the subcontract method when red tape stymied efforts to lease or purchase a surplus plant through RFC or DPC. Under the arrangement with the Texas company, Fairchild will handle all orders and sales for the F-24. It is expected that similar contracts will be written between Fairchild and other companies, if demand for the plane increases.

Although Fairchild has not adopted the subcontract plan as a policy, it is generally known that the company's return to comparatively large-scale participation in the personal plane market still is a question mark in the minds of its engineers and sales experts. Reason for their reluctance to plunge headlong into a market of doubtful proportions is the knowledge that personal plane sales have not paid off substantially to any company.

However, Fairchild is continuing research for an improved personal plane design and expects to evolve one that will attract the mass market. The M-84, flown for the first time in December, does not appear to be the answer to the problem and probably will not go into production.

New CAA Brochures

One of the most ambitious color printing jobs ever attempted by a government agency will be on the CAA publications list soon in the form of three booklets to be sold through Government Printing Office—*Path of Flight*, due early in January; *Realm of Flight*, scheduled for the end of February, and *Facts of Flight*, expected in the early spring. Art work was prepared by the Visual Services of CAA's Office of Aviation Information under Ben Stern, Assistant Administrator.

Air Jobs for Veterans

Returning veterans attempting to determine how they can fit their wartime knowledge and skills into peacetime aviation should study thoroughly "Civilian Jobs for Airmen" in the January, 1946, issue of FLYING and "Aviation Jobs for Veterans," a new study by National Aeronautics Association. Together, the articles constitute the most comprehensive survey of the aviation job situation yet prepared to aid men and women returning to civilian life. FLYING's article includes (pages 24 and 25) a chart which shows at a glance the civilian job most closely related to a particular air forces specialty. Invaluable to the veteran studying the NAA survey, available at 1025 Connecticut ave., Washington, D. C., is a sample form outlining the kind of information an employer will need to give the veteran's application intelligent consideration.

CPT Revival

Although T. P. Wright, Administrator of Civil Aeronautics, considers reinstatement of the Civil Pilot Training Program very important to the function of the CAA (see "Our Plans for 1946," FLYING, January, 1946), it is a dead duck. Reason: The CAA request for a supplemental appropriation of $3,000,000 to finance CPT between January 1 and June 30, 1946, was denied by the budget bureau. A request for CPT funds for the fiscal year beginning July 1, 1946, will be submitted because the act authorizing CPT expires on June 30, 1946. The budget bureau decision satisfies those who are convinced that a CPT program is no longer necessary to stimulate interest in flying.

Flight Records

The AAF, in cooperation with manufacturers, is planning to attempt to establish new records of airplane performance in every important category. Lockheed's *Shooting Star* soon will be sent out to break the British-held speed mark of 606 m.p.h. in level flight.

On December 8, Douglas' XB-42 set a new unofficial transcontinental speed record by flying from Long Beach, Calif., to Bolling Field, Washington, D. C., in 5 hr. 17 min. 34 sec., an average ground speed of 432 m.p.h. The bomber had been poised on the West Coast for weeks awaiting favorable weather that would provide a good tail-wind over the 2,295-mile course. Altitude records for multi- and single-engine military types and another try for range also are planned. Aircraft manufacturers are as eager as the AAF to set new records, because superior performance sells planes in the export market.

Dust Gatherer

The Pitcairn roadable autogiro, developed in 1935 during CAA's "venture into the future" to find a low-cost roadable family airplane, will be transferred soon to the Smithsonian Institute. Shipped by rail from Willow Grove, Pa., the autogiro was driven through the streets of Washington on December 1 to a National airport hangar by John Geisse, Assistant Administrator of CAA with Phil Mindell, chief CAA mechanic at National airport, as a passenger. Front wheels of the autogiro are steerable and road power is through gearing to the tailwheel.

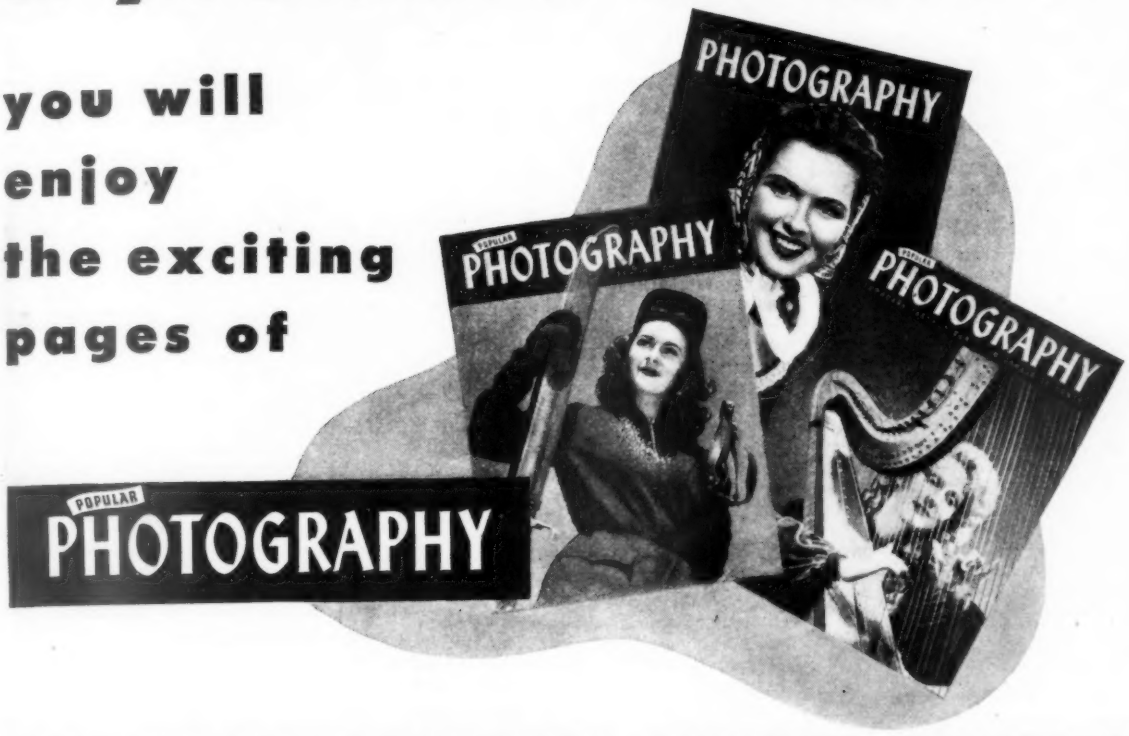
When built, the Pitcairn-CAA craft had a 90 h.p. Pobjoy engine. The autogiro is 26 feet long and rotor blades when extended have a 34-foot, 3½-inch diameter. A Washington newspaper commented in an editorial entitled "Born 30 years too soon?" She's now both obsolete and still ahead of her time.

Personal

Lieut. Col. Richard E. Elwell, who has been with the AAF in Europe, will return soon to take over his old post as counsel to the CAA. Edward E. Slattery, Jr., is expected to resume his duties as director of public information for the CAB early in 1946. John F. Warlick, who served as a major in air-sea rescue work, is back with CAA as regional counselor in domestic operations. Eugene E. Norris, former director of technical services for Aircraft Industries Association, has joined Luscombe Airplane Corp. as chief engineer. Ivar C. Peterson succeeds Norris. The Institute of Aeronautical Sciences has elected Arthur E. Raymond, vice president of Douglas, as president to succeed Charles H. Colvin. END

If you use a camera . . .

you will enjoy the exciting pages of



AMERICA'S GREATEST CAMERA MAGAZINE

Readers of FLYING who are also camera fans will find POPULAR PHOTOGRAPHY a perfect companion magazine. With wartime restrictions removed from air travel and camera use, new photographic possibilities are endless . . . and POPULAR PHOTOGRAPHY will help you to know your camera, use your camera, enjoy your camera.

POPULAR PHOTOGRAPHY, like FLYING, is a Ziff-Davis publication—edited with the same care and imagination you are accustomed to find in FLYING. It is famous for its down-to-earth camera information . . . for its expert picture-making and picture-taking advice . . . for its authoritative articles by and about leading photographers . . . for its home movie and color film ideas . . . and for its monthly salon pages which contain striking examples of the best in photography today. Issue by issue, it is a record of the photographic world—exciting, inspiring, informative.

You'll be using your camera more and more in America's air age—let POPULAR PHOTOGRAPHY help you make the most of it. Ask for the current issue at your newsstand today—it's on sale everywhere!

25¢ at Newsstands everywhere

A ZIFF-DAVIS PUBLICATION

Flying • Popular Photography • Radio News • Radio-Electronic Engineering • Industrial Aviation • Plastics • Radio & Appliances

Aviation Reconverts to Peace

(*Continued from page 29*)

the dollar value of total aircraft production increased from $342,000,000 to $16,745,000,000.

The working force of 48,638 employed in the aircraft industry expanded to a peak of 2,102,000 in November, 1943, the wartime high. On the latter date aircraft plants employed 12.4 per cent of the total manufacturing employees in the United States.

Many aircraft manufacturers now feel that their future—especially the prospect of keeping aircraft design and production teams intact—is being shaped behind the oaken doors of the U. S. Senate's Military Affairs Committee, which will determine the extent of our military procurement program. Meanwhile, Assistant Secretary of War for Air Lovett and the Air Forces' planners are believed to have agreed that the largest single allotment of funds spent on research and development in the AAF's peacetime program will be for pilotless aircraft and guided missiles.

The cutbacks, varying according to the immediate requirements of the Army and Navy air forces, were met with a wide range of solutions within the industry. Most companies first lopped off their subsidiary plants. Some companies retained a large share of their employees while they waited to learn the extent of the cutbacks. Some were practically depleted of workers. Others, with large backlogs of commercial orders, swung into the problem of reconversion.

Lockheed and Douglas were in the best position for the manufacture of commercial transports and passenger airliners. But all companies continued experimental work while closing down less essential units. Secret developments in various stages on jet-propelled planes, projectiles, guided missiles, did not suffer from cutbacks.

Gen. Henry H. Arnold, chief of the AAF, testifying before a Congressional Committee pondering the establishment of a Federally-supported research foundation, disclosed that it is already possible to make a guided missile out of the atomic bomb "merely by putting wings on it and adding a television head."

The industry has pledged to maintaining experimental work to the extent that American airpower never again will have to start from scratch if another war breaks out. The next time, they fully realize, there will be no time for catching up, for improvising and trusting to geography.

The West Coast manufacturers, Boeing, Consolidated Vultee, Douglas, Lockheed, Northrop, North American and Ryan, who organized themselves into the Aircraft War Production Council, were perhaps a step or two ahead of the rest of American aircraft companies in formulating peacetime plans. Outside of whatever military and naval orders came through, those who built heavier planes during the war will concentrate on the production of high altitude, high speed, long range transports. Entered in this field are Douglas, Consolidated, Lockheed and Boeing.

Experimental work in the development of long-range jet transports, although believed to be years away, is going ahead continuously. All transport builders are, for the present, concentrating on planes with standard power plants.

Manufacturers of lighter planes, fighters, attack bombers and trainers, have indicated they will venture into the private plane field. But at present they will not go beyond these generalities.

According to the Aircraft War Production Council, Pacific Coast manufacturers believe they will have 60 per cent of the total U. S. production which, it has been indicated, will amount to about 10 per cent of the wartime peak. Thus, they expect that the dollar value of their gross sales in the post-war era—with 16 billion dollars plus as the wartime peak (1944) for the U. S.—will be about 960 million dollars annually.

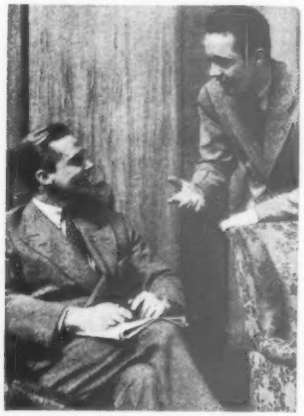
Pacific Coast manufacturers belonging to the AWPC produced a total of 125,823 warplanes. Following is a resume from the best available figures of how they are effected by cutbacks and reconversion, their industrial performances and their prospects, including total backlogs as of November, 1945.

BOEING—At its wartime peak Boeing employed 34,700 persons, reduced to 8,000 by September 10, 1945. It produced 18,165 planes from 1938 to V-J day. Factory space at wartime peak comprised 5,657,000 square feet. At the present writing Boeing holds Government contracts for 20 per month of the advanced model of the *Superfortress*, and airline contracts for the *Stratocruiser*. Possibly lightplanes will also be built. Boeing's peak backlog total was $1,500,000,000, but the current backlog is undisclosed.

CONSOLIDATED VULTEE—At its wartime peak, Consolidated employed 45,000 at its San Diego plant, reduced to 2,500 by September 10, 1945, while its Vultee Field plant employed 7,600 at wartime peak, cutback to 1,700 by September 15, 1945. It produced a grand total of 36,289 military planes up to June 1, 1945. Factory floor space at wartime peak was 4,483,000 square feet at Convair and 62,650 square feet at Vultee Field. At the present writing developmental work is continuing on the B-36, Model 37, the Stinson *Voyager* and another still restricted plane, a jet bomber. In the mock-up stage is Model 110, a bid for short-haul commercial runs. Current military backlog, $220,000,000.

DOUGLAS—At its wartime peak Douglas employed 101,000, cut back to approximately 30,000 by September 10, 1945. It produced a total of 31,304 planes from 1939 to V-J day. In 1940, 584 planes of all types were produced; in 1943, 9,017; in 1944, 11,594, and in 1945, 5,156. Factory floor space comprised 7,675,100 square feet at wartime peak. At present writing C-74 production will continue at the Long Beach plant, where one C-74 is flying and five others are building. Production of *Skymasters* may continue at the Santa Monica plant on a reduced basis. *Invader* production at Long Beach was terminated. Experimental work for the Navy at the El Segundo plant will continue on the same basis as before. The DC-8 (*Skybus*) will soon reach the assembly lines, as well as the DC-6 pressurized airliners. Experiments in jet propulsion are under way as are guided missiles. Current backlog total: $266,000,000, which is expected to be cut significantly.

LOCKHEED—At its wartime peak Lockheed employed 86,000 workers, cut back to 35,000 on September 10, 1945. It produced a total of 19,413 planes from 1939



Many Roosevelt graduates are now in business for themselves as operators of approved aircraft and engine repair stations.

"Why don't you become a licensed Airplane Mechanic?"

"Jim, you'd certainly make no mistake in choosing aviation for your career as I did," said Dick. "It's the field of the future—and licensed mechanics are in demand."

"Just what is a licensed airplane mechanic?" asked Jim.

"He services planes and is able to make complete overhauls. Every repair station must have a licensed mechanic. All others, no matter how experienced, must work under the man with the license. When you graduate from Roosevelt Aviation School, you're qualified to take the CAA exam for your license if 18 or over. Lots of fellows who have been discharged from the Army Air Forces are training there to get their licenses."

"And naturally, the best place to prepare for all this is Roosevelt—where you're studying now?" Jim teased.

"Natch! It's a swell school — on famous Roosevelt Field."

Jim frowned. "But what if I'm drafted?"

"Then your license will put you in line for a better rating. And if you're not needed, you can enter commercial aviation as a licensed mechanic. You can't lose!"

Qualify in 24 weeks for either Airplane or Engine Mechanic's license—or for both in 48 weeks—if 18 or over when you complete course. Approved for veterans under G.I. Bill.

Send Today!

NEXT CLASSES BEGIN FEB. 4, MARCH 4

ROOSEVELT AVIATION SCHOOL 2-46
Hangar 23, Mineola, L. I., N. Y.
I'd like to know how I can become a licensed Engine ☐ or Airplane ☐ Mechanic in six months or both ☐ in 48 weeks.

NAME..... AGE.....

ADDRESS .....

ROOSEVELT
AVIATION SCHOOL
MINEOLA, LONG ISLAND, N. Y.
Phone Garden City 8000

She wears the wings of AOPA . . .

FROM MRS. ALMA CRUTCHER
AOPA PILOT 10221

"During the past year I have benefited from the AOPA and have thoroughly enjoyed being a member. I was very happy to renew my membership and will continue to do so for many years to come."

Many Services FREE to Members

The Washington staff of AOPA will help you in personal flying problems, licenses, regulations, legal tangles, plane sales and purchases, documents, employment. You are also entitled to national AOPA-Hertz Drive-Ur-Self courtesy card with special rates: AOPA Washington Newsletter; AOPA edition of FLYING magazine; TWA-AOPA courtesy card assuring service and maintenance facilities at most TWO airports; distinctive AOPA pilot's wings, emblems for your plane and car, and membership card.

And Pilot Alma Crutcher is not alone. There are many other capable women flyers who are also wearing the wings of AOPA. Women, as well as men, know the value and the benefits of the services offered by AOPA—the greatest organization of non-scheduled owners and pilots in the world.

AOPA is non-profit, of course, and during its years of activity has been dedicated to one purpose—protecting the interests of its members in every phase of civilian flying. The voice of AOPA is powerful and respected because it is the united voice of thousands of member pilots, and its objective for the future, as in the past, is to make personal flying safer, more enjoyable, and less expensive. If you have soloed you are eligible for membership and are invited to join.

TAKE A TIP FROM AOPA MEMBERS

JOIN AOPA NOW

Write today for full particulars, or use the convenient membership application on this page. Dues are nominal, only $5.00 annually, with many free services included.

AOPA

AIRCRAFT OWNERS AND PILOTS ASSOCIATION
National Headquarters, Dept. F-246
Room 802, 1319 F Street NW,
Washington 4, D. C.

I first soloed an airplane at.....In the year.....
I hereby apply for membership in AOPA.
Enclosed find check or money order for $5.00

NAME .....
Please Print

ADDRESS .....

CITY & STATE.....

PILOT LICENSE NUMBER.....

SIGNATURE .....

"AOPA"
AIRCRAFT OWNERS AND PILOTS ASSOCIATION

NATIONAL HEADQUARTERS ★ ROOM 802, 1319 F STREET NW, WASHINGTON 4, D. C.

to V-J day. In 1940, 390 were produced; in 1942, 3,455; in 1944, 5,863, and in 1945, 2,582. Factory floor space comprised 7,247,000 square feet at wartime peak. At present writing Lockheed's possibilities in the military line have not been clarified. They probably will be defined when the Military Affairs Committee of the Senate makes its decision. Rocket fighters may be produced. Lockheed is producing private planes. The company has a large backlog of commercial transport orders. For the latter use, Lockheed will build the *Constellation*, *Constitution* and *Saturn*. Current backlog total, $259,106,000 which is also expected to be pared considerably.

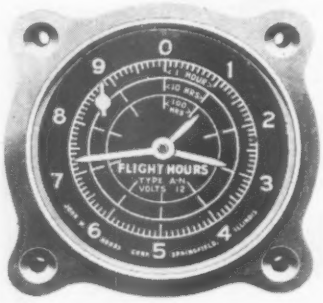
NORTH AMERICAN—At wartime peak North American employed 24,600 workers, cut back to 8,000 by September 10, 1945. It produced a total of 42,503 planes from 1938 to V-J day. In 1940 a total of all types manufactured was 1,230; in 1943, 9,108; in 1944, 14,862; in 1945, 7,921. Factory floor space comprised 8,250,800 square feet at wartime peak. At writing North American plans to manufacture jet planes for both Army and Navy, including fighters and heavy bombers, and private planes. Current backlog total, $31,000,000, which may be increased.

NORTHROP—At wartime peak, Northrop employed 9,200 workers, cut back to 3,700 by September 10, 1945. Factory floor space comprised 1,261,000 square feet at wartime peak. Figuring in Northrop's future are wing-type fighters, bombers and possibly transport planes, using either pure jet or gas turbines, both types of power plants now being perfected by the company independently. Research work will be heavy. Current backlog total, $51,000,000, which may be increased.

RYAN—At wartime peak Ryan employed 8,600 workers, cut back to 2,000 by September 10, 1945. Current backlog total, $27,000,000. Ryan has a Navy order for a plane more advanced than the FR-1, probably using the same jet-radial engine combination. A private plane may also be anticipated.

The status of other aircraft manufacturers at present writing is as follows:

CURTISS-WRIGHT—Cutbacks in the 180,000 employees in their 17 plants, as of early December reached a point between 85 and 90 per cent of the wartime peak.



FLIGHT METER

AN INSTRUMENT to record flying time, a flight hour meter activated by an air switch, has been developed by the John W. Hobbs Corp. The device has three hands; largest makes one revolution every 10 hours of flight, a smaller hand revolves once every 100 hours, and the smallest every 1,000 hours.

The air switch, mounted on plane's wing inspection plate, actuates the meter by air pressure. On take-off, 40-m.p.h. speed will open switch; when landing, decreased speed will automatically close it:

Made for six-, 12-, or 24-volt D.C. operation, the meter, weighing only eight ounces, can be mounted on the instrument panel or elsewhere in the cockpit.

All Navy production orders were completed as of October 31, 1945, leaving only a few orders for advanced types.

The order backlog for planes, propellers and engines, $115,000,000 as of October, has already been revised downward.

GLENN L. MARTIN—Martin has a peacetime backlog of $190,000,000 for both military and commercial planes. Now in Navy use, the *Mars* figures in Martin's plans for making the airlines his postwar customers. Martin is also working on several versions of his feeder-line transport, Model 202, for which many orders have been received. Continuous 40-hour-week operation at the Baltimore plants is possible until September, 1946, with the contracts on hand. Experimental work includes development of a new strato-type plane with Westinghouse.

BELL—At its Marietta, Ga., plant work has been stopped on *Superforts*, but the company has started negotiations for the acquisition of the Niagara Falls facilities. Production of *Kingcobra* fighters has ended because of outright cancellations. New York plant would be used for production of commercial, industrial and military helicopters. Current backlog, approximately $34,000,000.

UNITED AIRCRAFT—Pratt & Whitney engine plant laid off 17,000 workers indefinitely; other production schedules established on materially reduced scales. Much work will be devoted to building the *Wasp Major*, 28-cylinder 3,250-h.p. engines which are scheduled to power most of our military transports and Navy fighters in the near future. Vought division is scheduled to continue reduced production of *Corsair* fighters. Sikorsky is slated to continue with helicopter work. Current backlog total, $130,000,000.

REPUBLIC— The cutbacks following V-J day left Republic with $30,000,000 worth of military orders, which include the military *Thunderbolt* and the civilian *Seabee*. Republic plans to retain half of its 10,000 employees, though Evansville, Ind., plant will be closed. The company retains all experimental contracts and development of a new Army plane will continue. Commercial and personal planes are also on its schedule, including the big four-engined *Rainbow*, already ordered by Pan American. The *Rainbow* will be powered by Pratt & Whitney *Wasp Majors* coupled with jet exhausts.

GRUMMAN—This company estimates it will need four or five times as many employees for post-war work as it carried on pre-war payrolls. Continued production of the *Tigercat* and the *Bearcat* and commercial amphibian planes is planned.

FAIRCHILD—Expectations are that production of the *Packet* will continue at a moderate rate for some time, though contracts for the plane have been reduced by 82 per cent. Current backlog total, $85,000,000.

FORD—Robot bomb engine contracts continued at River Rouge plant, though production terminated on Pratt & Whitney aircraft engines at the same plant and cargo gliders at the Ford Iron Mountain, Mich., plant.

CHRYSLER—Contracts terminated for *Superfortress* and B-32 engines at its Chicago plant. END

AERONAUTICAL UNIVERSITY OF CHICAGO

● You will make no mistake in choosing Aviation for your postwar career. Tremendous opportunities are in sight—and those who are best trained will get top positions.

Prepare for your entrance into key positions in Aviation by intensive training at this oldest fully approved aeronautical school. Courses in:

Aeronautical Engineering—B.S. Degree
Engine Mechanics
Special A. and E. Mechanics Refresher and Coaching Courses for U.S. Civil Aeronautics Administration Examinations—including sales—Also short courses

New Term Starts Feb. 4

U. S. Government pays for qualified veterans' attendance at Aeronautical University.

Founded by Curtiss-Wright. Outstanding faculty, modern equipment. Day, evening. Placement service. Send today for free illustrated catalog—"Opportunities in Aviation."

AERONAUTICAL UNIVERSITY OF CHICAGO
Dept. 2, 116 S. Michigan Ave., Chicago 3, Ill.

(Member of the National Council of Technical Schools)

New SPARTAN Courses Prepare You in 90 Days!

Thousands of high pay administrative jobs are opening in aviation—for men and women all over the world.

Tremendous fields exist in Airline Traffic and Reservations . . . Job opportunities for which you can qualify QUICKLY. New courses now offered at Spartan equip you IN 90 DAYS for positions in these important departments: Airline Traffic; Ticket and Reservations; Passenger Relations; Airport Staff, etc.; and surveys of the industry show the demand is for pre-trained personnel.

In only 90 days longer—six months in all—Spartan graduates can qualify as Airport Managers; Control Tower Operators; or for countless other airport management and operation positions being created by today's globe-girdling airline networks. For the air-age job you've dreamed of—Send TODAY for full details on these fast new Training Courses and for SPARTAN'S Master List of job opportunities. Address: Spartan, Tulsa, Oklahoma, Department AT 246.

Take Your Pick
OF THESE TOP-PAY POSITIONS
AIRPORT MANAGER: With new airports dotting the earth in ever increasing numbers, the need for trained executives to manage them is greater than ever before.
TRAFFIC MANAGER: The volume of air traffic has already reached undreamed of proportions. It is increasing daily and brings a world of traffic management opportunities.
TICKET OFFICE
RESERVATIONS: Airline ticket and reservation offices offer brilliant and fascinating futures to persons with proper training for this important phase of the air-travel picture.
CONTROL TOWER OPERATOR: A vital role in a vast activity. Men and women alike may qualify for these colorful, exciting and highly specialized positions.

SPARTAN
UNIVERSITY OF AVIATION
SCHOOL of AERONAUTICS — CAPT. MAXWELL W. BALFOUR
COLLEGE of ENGINEERING — DIRECTOR, ADDRESS DEPT. AT 246
TULSA, OKLAHOMA

Approved for Veteran's Training under G.I. Bill of Rights.

Fifty Acres Of Educational Facilities Devoted EXCLUSIVELY To Every Important Brand Of Aviation Training

Make Money in Postwar Aviation
Be an
INSTRUMENT TECHNICIAN

Permanently profitable careers will be open to men who become specialists in aircraft instruments, through A.S.A.I. training. For every type of plane—for airlines, commercial, private and military flying—skilled technicians will install, test and repair the extensive instrument sets required by modern aviation. These will be interesting, well paid positions, with a real future. Great networks of global airlines will demand trained specialists for instrument maintenance. *Now* is the time to prepare for this growing field, at American School of Aircraft Instruments... oldest instrument school in America.

VETERANS! SERVICEMEN!
American School of Aircraft Instruments is among the schools approved by the Veterans Administration, so that discharged veterans who attend are eligible for educational benefits under the G. I. Bill of Rights.

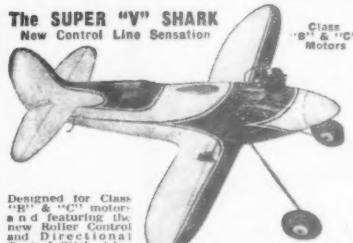
AMERICAN SCHOOL OF AIRCRAFT INSTRUMENTS, Dept. F-2
Including Accredited Watchmaking School
5255 W. San Fernando Rd., Los Angeles 26, Calif.

SEND TODAY
for this Interesting 24-page Booklet

AMERICAN SCHOOL OF AIRCRAFT INSTRUMENTS, Dept F-2
5255 W. San Fernando Rd., Los Angeles 26, Calif.
Please send me your illustrated 24-page booklet and full information on the MASTER INSTRUMENT TECHNICIAN Course
Name_____ Age_____
Address_____
City_____ Zone____ State_____
Check One: ☐ Veteran ☐ In Service ☐ Civilian

SUPER G-LINE MODELS
Now Available

The SUPER "V" SHARK
New Control Line Sensation
Class "B" & "C" Motors



Designed for Class "B" & "C" motors and featuring the new Roller Control and Directional Control Stick, the SUPER "V" SHARK flies at speeds up to 120 M.P.H. with unusual stability and ease of control. The CONSTRUCTION KIT, complete to the finest detail, is now available at only $4.95. Plus 30c Postage.
Descriptive Literature 5c
VICTOR STANZEL & CO., Dept. P., SCHULENBURG, TEXAS
First In Control Line Flying

Local Airlines

(*Continued from page 32*)

state. Second, CAB certification, carrying with it the all-important rights to carry airmail at well-paying rates, spells the difference between financial success and failure. Airmail payments were once considered a subsidy to major airlines. There is no reason why they cannot be so considered for the smaller airlines. Just as the big lines needed airmail to get established, so do the small lines need such a subsidy.

Extremely promising in the way of potential airmail payments has been the success of All American Aviation, now in its seventh year of operation. All American has relied on its airmail pickup system for revenue and has subsisted solely on airmail for revenue. In its seven years of operation it has become self-sustaining through airmail alone and is now producing a substantial profit for the Post Office Department.

Congressman Jennings Randolph of West Virginia believes that the Civil Aeronautics Act gives both the CAB and the Post Office Department sufficient authority to proceed with the expansion of the domestic air transportation system to include the smaller as well as larger cities and towns and that no additional legislation is required.

Even so, the small airlines face difficult times. In its recent feeder lines report, the CAB cautioned that the airplane will be faced with the most intense kind of competition from surface carriers in going into the small-city, short-haul market.

". . . It becomes apparent that the provision of a short-haul and local service with aircraft will be, in a very great measure, an experimental operation and constitutes a problem with respect to which we have little or no information of a factual nature," the CAB said.

"But since the challenge exists, and the investigations disclosed an eagerness on the part of the proponents of such a service to take up the challenge, and since the experiment may well result in public benefit beyond present expectations, the responsibility imposed upon us to encourage the development of an air transportation system . . . justifies us, within reasonable bounds, in translating into results of experience what are now plans and estimates." END

Retraining the G. I. Mechanic

(*Continued from page 34*)

poured in to the airlines and the pressing problem was solved. The incident demonstrated one important fact, however. Out of the hundreds of applications received, only a handful possessed CAA mechanic certificates.

A few A & E men will be picked up by commercial air carriers from workers released through cutbacks in airplane manufacturing. Industry spokesmen assert, however, that there still will be an "appreciable need" for mechanics with CAA certification and it will increase as the planned expansion programs of the airlines get under way—and that should be in the very immediate future.

In addition to the needs of the airlines, trained personnel will also be required to support the anticipated post-war boom in private flying. END

PHOTO CREDITS

The following list shows the source from which pictures used in this issue were gathered. Where a single page is indebted to several sources, credit is recorded left to right, top to bottom.

4—CONSOLIDATED VULTEE
21—HANS GROENHOFF
22—M. G. SCHNECKENBURGER, HAWTHORNE FLYING SERVICE, INC., AOPA
23—HAWTHORNE FLYING SERVICE, INC.
24—CAA
25—GRANTHAM GRAPHICS (2)
26—ELLIOTT & ELLIOTT
27—FRANK ROSS
28—DOUGLAS, AAF
29—DOUGLAS, AAF
30—FRANKLIN CARR
31—LOVE'S STUDIO, BOWLING GREEN, KY. (2)
32—TRANS-MARINE
33, 34—AAF BASE PHOTO
35—ACME
36—HAL MORRIS, ACME (2)
37—ACME
38—COURTESY BULLETIN OF THE AIR POWER LEAGUE
39—BRITISH OFFICIAL
40—FREEDMAN PHOTO, BERTHA KLAUSNER
41—SCHOEV PHOTO, BERTHA KLAUSNER
42—AMERICAN AIRLINES, UNITED AIRLINES
44—STINSON, USN
45—USN
46-48—ARTHUR E. HAUG
49—H. R. FOOTTIT
50—CENTRAL PRESS PHOTOS, LTD.
51-82—AAF
83—STINSON
84—McCORMICK-ARMSTRONG, CAA, USN
85—USN (3), BALLARD, PIPER AIRCRAFT, NORTHROP
86—BELL, ARTHUR E. HAUG, HOWARD LEVY, DON DOWNIE, PASADENA JUNIOR COLLEGE, USN
87—NEW YORK DAILY NEWS
112—AMERICAN AIRLINES
132—JOHN W. HOBBS CORP.